IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

DISH NETWORK CORPORATION (F/K/A ECHOSTAR COMMUNICATIONS CORPORATION), ECHOSTAR DBS CORPORATION, ECHOSTAR TECHNOLOGIES LLC (F/K/A ECHOSTAR TECHNOLOGIES CORPORATION), ECHOSPHERE LLC, AND DISH NETWORK LLC (F/K/A ECHOSTAR SATELLITE LLC), Plaintiffs,	
v.	C.A. No. 08-327-JJF
TIVO INC., A DELAWARE CORPORATION, Defendant.	**DEMAND FOR JURY TRIAL**

DECLARATION OF RACHEL KREVANS IN SUPPORT OF ECHOSTAR'S OPPOSITION TO TIVO'S MOTION TO DISMISS

REDACTED (PUBLIC) VERSION

sf-2556439

I, Rachel Krevans, declare:

1. I am a member of the bar of the State of California. I am a partner with the law firm of Morrison & Foerster LLP, counsel of record for Plaintiffs in the above-captioned action. Except where otherwise stated, I have personal knowledge of the facts set forth in this declaration, and, if called as a witness, I could competently testify to them.

2. Attached as Exhibit A is a true and correct copy of United States Patent No. 6,233,389, issued on May 15, 2001 to Barton *et al.*

3. Attached as Exhibit B is a true and correct copy of the Texas court's Claim Construction Order, which was issued on August 18, 2005.

4. Attached as Exhibit C is a true and correct copy of relevant excerpts from the March 30, 2006 p.m. Transcript of Trial before the Honorable David Folsom United States District Judge and a Jury in the above-captioned case.

5. I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on August 6, 2008, in San Francisco, California.

Rachel Krevans

EXHIBIT A

US006233389B1

(12) **United States Patent**
Barton et al.

(10) **Patent No.: US 6,233,389 B1**
(45) **Date of Patent: May 15, 2001**

(54) **MULTIMEDIA TIME WARPING SYSTEM**

(75) Inventors: **James M. Barton**, Los Gatos; **Roderick James McInnis**, Milpitas; **Alan S. Moskowitz**, San Francisco; **Andrew Martin Goodman**, Menlo Park; **Ching Tong Chow**, Fremont; **Jean Swey Kao**, Cupertino, all of CA (US)

(73) Assignee: **TiVo, Inc.**, Alviso, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/126,071**

(22) Filed: **Jul. 30, 1998**

(51) **Int. Cl.**[7] **H04N 5/92**

(52) **U.S. Cl.** **386/46**; 386/68

(58) **Field of Search** 386/1, 33, 45, 386/46, 111–112, 125–126, 68; 369/60; 366/7, 33; 348/7, 10, 571, 714, 722, 725; H04N 5/76, 5/92, 9/79, 5/14

(56) **References Cited**

U.S. PATENT DOCUMENTS

Re. 33,535	2/1991	Cooper	358/149
4,313,135	1/1982	Cooper	358/149
4,665,431	5/1987	Cooper	358/145
5,202,761	4/1993	Cooper	358/149
5,371,551	12/1994	Logan et al.	348/571
5,438,423	8/1995	Lynch et al.	358/335
5,550,594	8/1996	Cooper et al.	348/513
5,572,261	11/1996	Cooper	348/512

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0726574	8/1996	(EP)	G11B/27/034

OTHER PUBLICATIONS

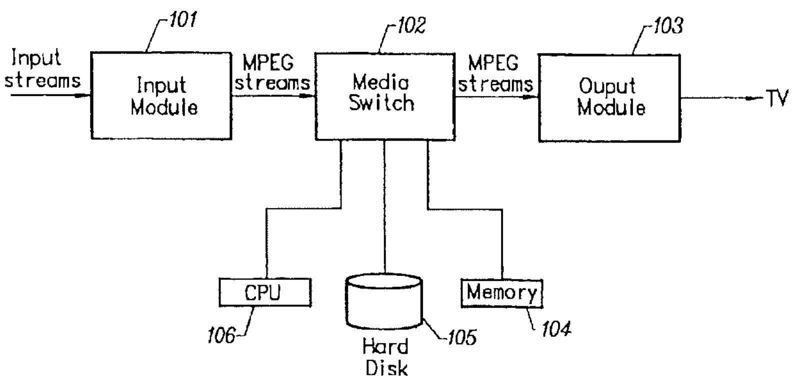
ASTARTE DVDirector™ Beta Testing Program.

Primary Examiner—Thai Tran
(74) *Attorney, Agent, or Firm*—Michael A. Glenn; Kirk Wong

(57) **ABSTRACT**

A multimedia time warping system. The invention allows the user to store selected television broadcast programs while the user is simultaneously watching or reviewing another program. A preferred embodiment of the invention accepts television (TV) input streams in a multitude of forms, for example, National Television Standards Committee (NTSC) or PAL broadcast, and digital forms such as Digital Satellite System (DSS), Digital Broadcast Services (DBS), or Advanced Television Standards Committee (ATSC). The TV streams are converted to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation and are parsed and separated it into video and audio components. The components are stored in temporary buffers. Events are recorded that indicate the type of component that has been found, where it is located, and when it occurred. The program logic is notified that an event has occurred and the data is extracted from the buffers. The parser and event buffer decouple the CPU from having to parse the MPEG stream and from the real time nature of the data streams which allows for slower CPU and bus speeds and translate to lower system costs. The video and audio components are stored on a storage device and when the program is requested for display, the video and audio components are extracted from the storage device and reassembled into an MPEG stream which is sent to a decoder. The decoder converts the MPEG stream into TV output signals and delivers the TV output signals to a TV receiver. User control commands are accepted and sent through the system. These commands affect the flow of said MPEG stream and allow the user to view stored programs with at least the following functions: reverse, fast forward, play, pause, index, fast/slow reverse play, and fast/slow play.

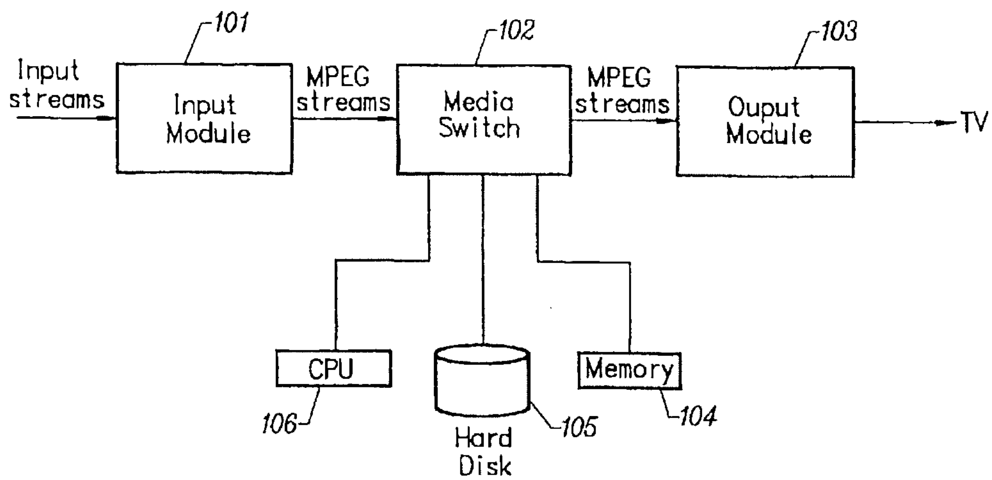
61 Claims, 12 Drawing Sheets



U.S. PATENT DOCUMENTS

5,675,388		10/1997	Cooper	348/461
5,696,868		12/1997	Kim et al.	386/46
5,706,388		1/1998	Isaka	386/125
5,787,225	*	7/1998	Honjo	386/111
5,920,842		7/1999	Cooper et al.	704/503
5,937,138	*	8/1999	Fukuda et al.	386/112

* cited by examiner



101
102
103
Input streams
Input Module
MPEG streams
Media Switch
MPEG streams
Ouput Module
TV
CPU
106
Hard Disk
105
Memory
104

FIG. 1

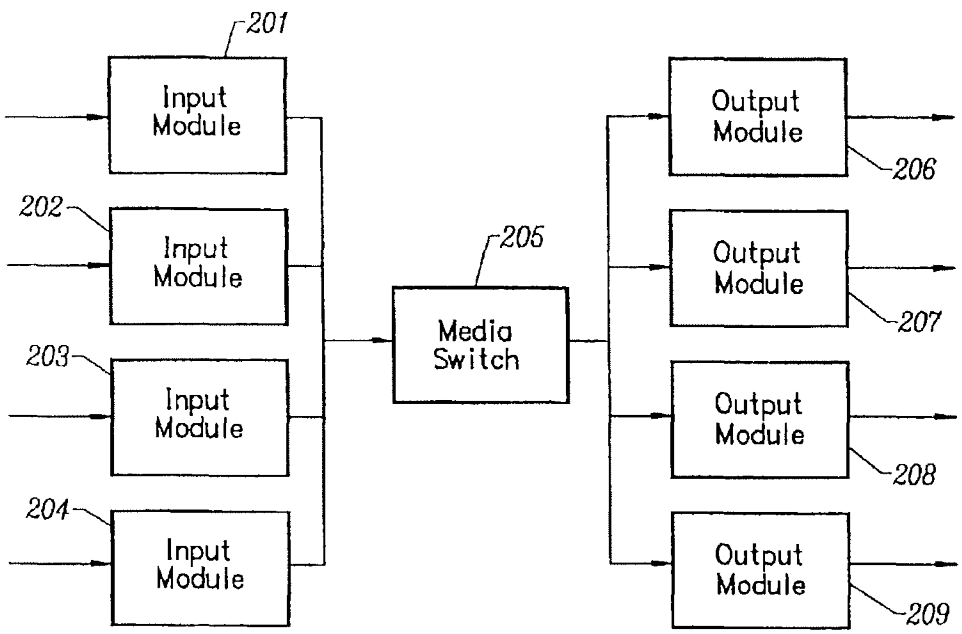

201
Input Module
202
Input Module
203
Input Module
204
Input Module
205
Media Switch
Output Module
206
Output Module
207
Output Module
208
Output Module
209

FIG. 2

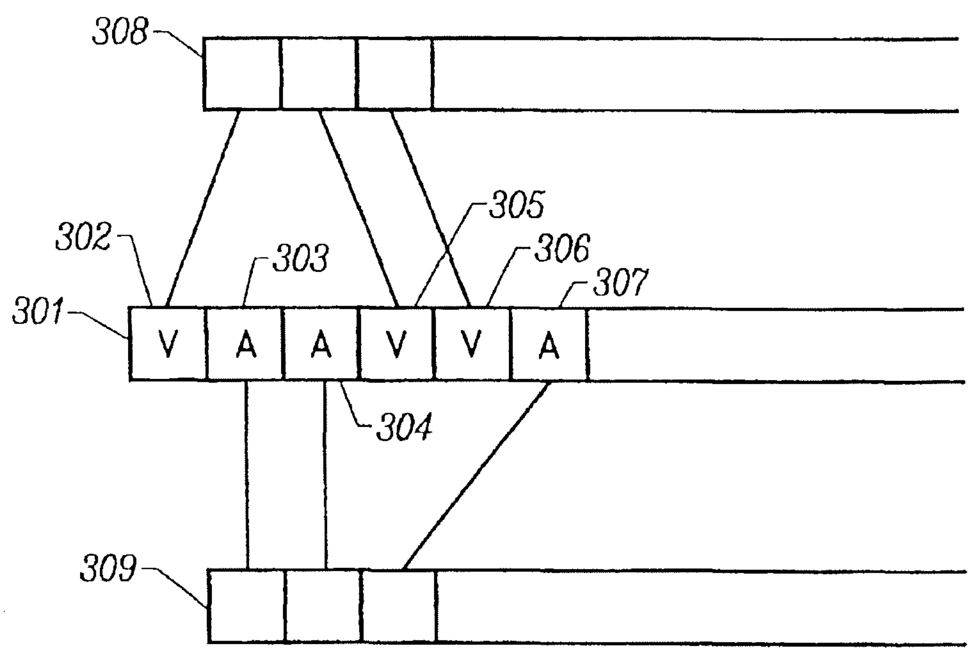
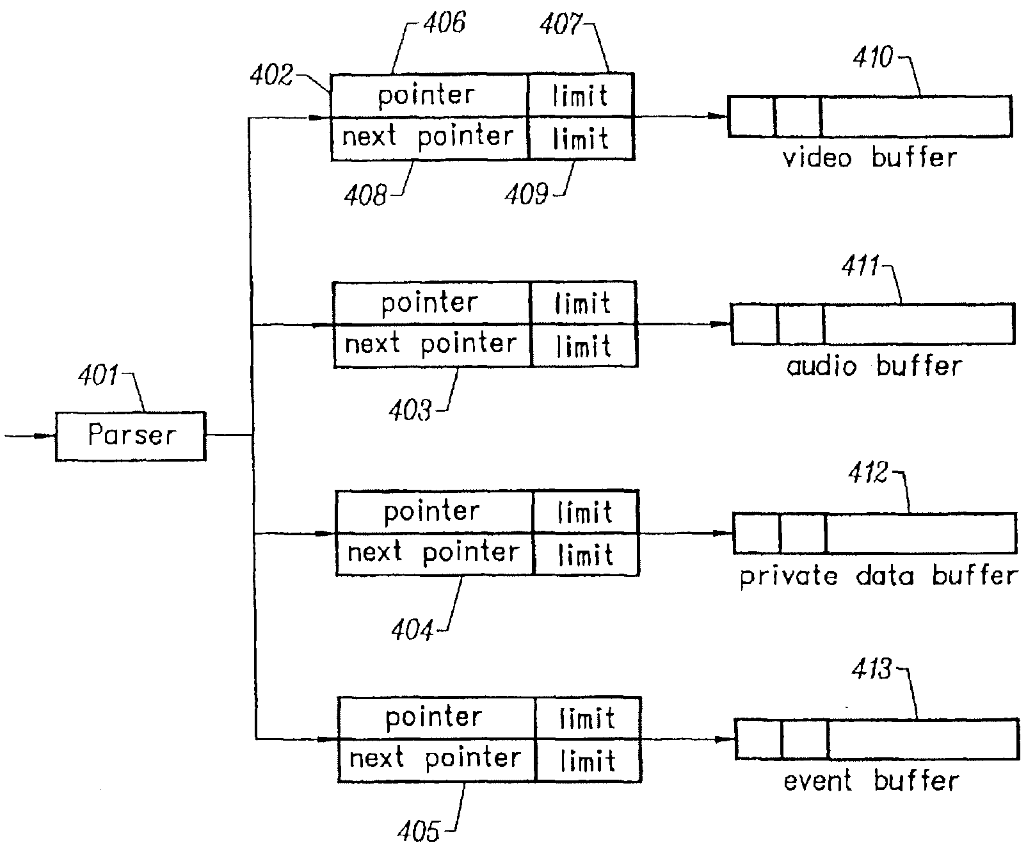
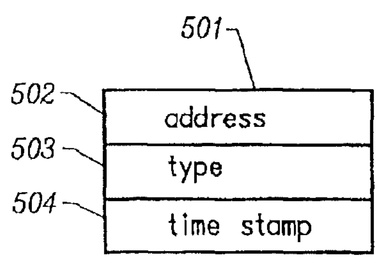


FIG. 3



406
407
402
pointer
limit
next pointer
limit
410
video buffer
408
409
411
pointer
limit
next pointer
limit
audio buffer
401
Parser
403
412
pointer
limit
next pointer
limit
private data buffer
404
413
pointer
limit
next pointer
limit
event buffer
405

FIG. 4



501
502
address
503
type
504
time stamp

FIG. 5

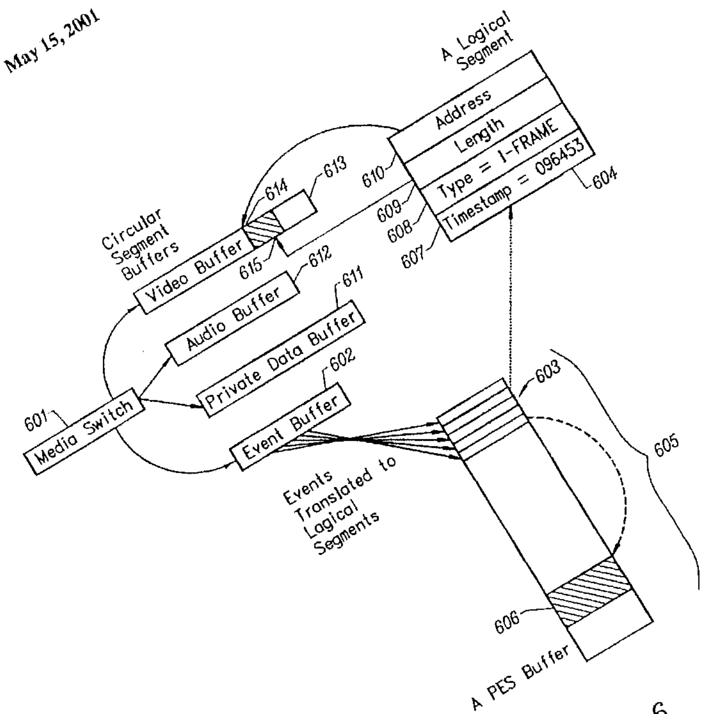

A Logical Segment
Address
Length
Type = I-FRAME
Timestamp = 096453
604
610
609
608
607
613
614
615
Circular Segment Buffers
Video Buffer
Audio Buffer
612
Private Data Buffer
611
Event Buffer
602
601
Media Switch
603
605
Events Translated to Logical Segments
606
A PES Buffer

FIG. 6

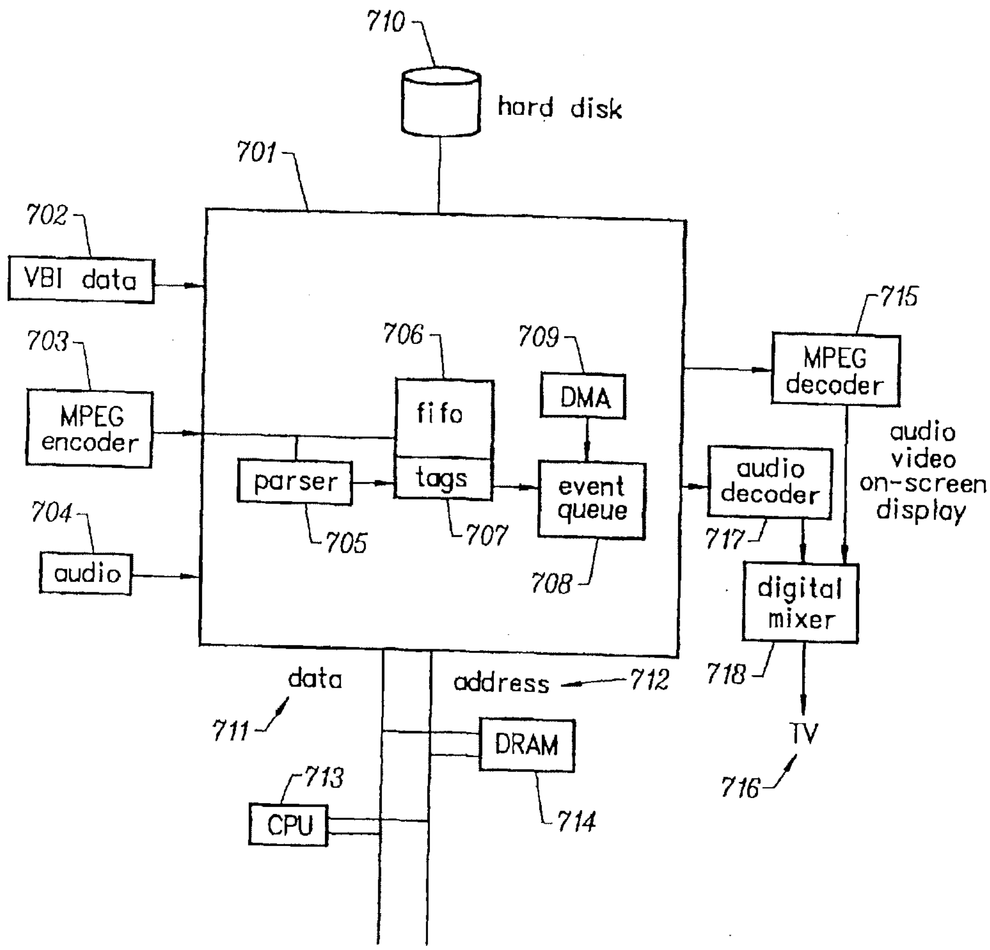

710
hard disk
701
702
VBI data
703
MPEG encoder
704
audio
706
fifo
tags
709
DMA
event queue
parser
705
707
708
715
MPEG decoder
audio video on-screen display
audio decoder
717
digital mixer
718
TV
716
data
address
712
711
DRAM
714
713
CPU

FIG. 7

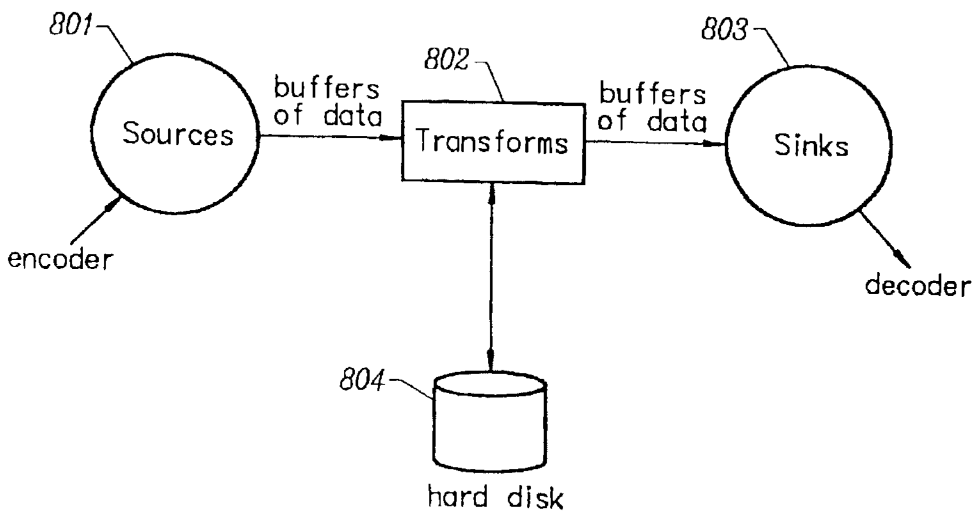

801
Sources
buffers of data
802
Transforms
buffers of data
803
Sinks
encoder
decoder
804
hard disk

FIG. 8

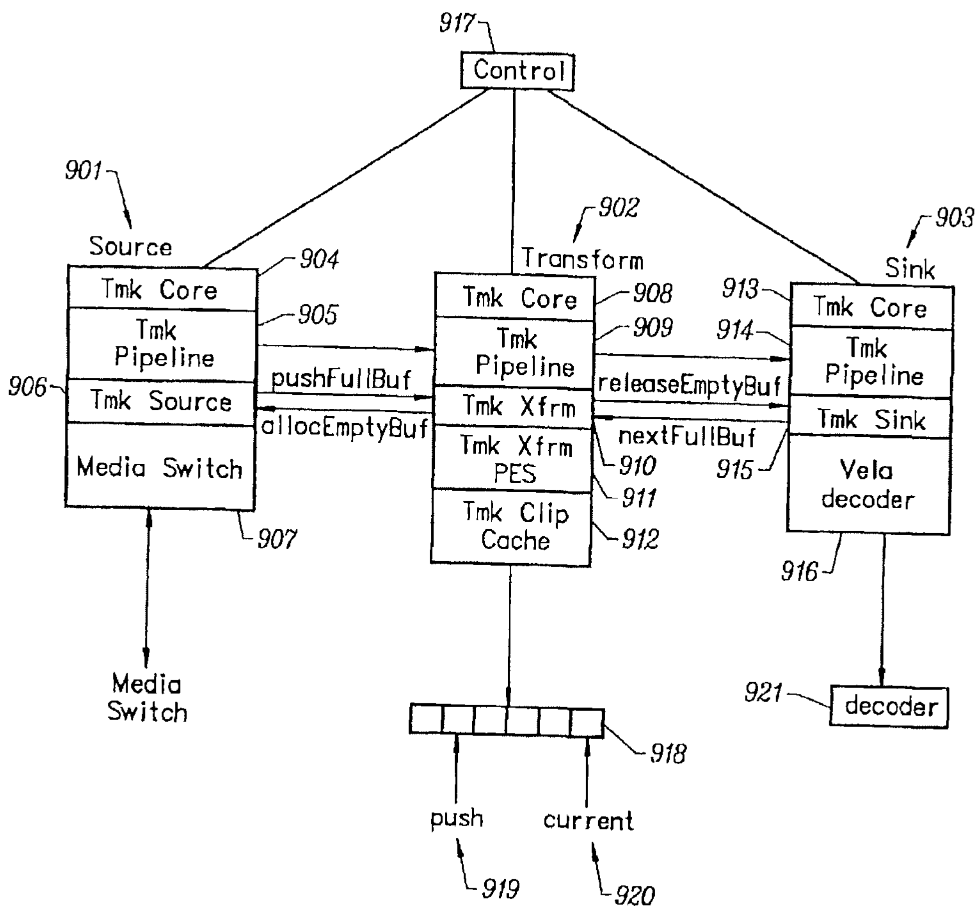

917
Control
901
Source
904
Tmk Core
905
Tmk Pipeline
906
Tmk Source
Media Switch
907
Media Switch
902
Transform
Tmk Core
908
Tmk Pipeline
909
pushFullBuf
allocEmptyBuf
Tmk Xfrm
Tmk Xfrm PES
910
911
Tmk Clip Cache
912
918
push
current
919
920
903
Sink
913
Tmk Core
914
Tmk Pipeline
releaseEmptyBuf
nextFullBuf
Tmk Sink
915
Vela decoder
916
921
decoder

FIG. 9

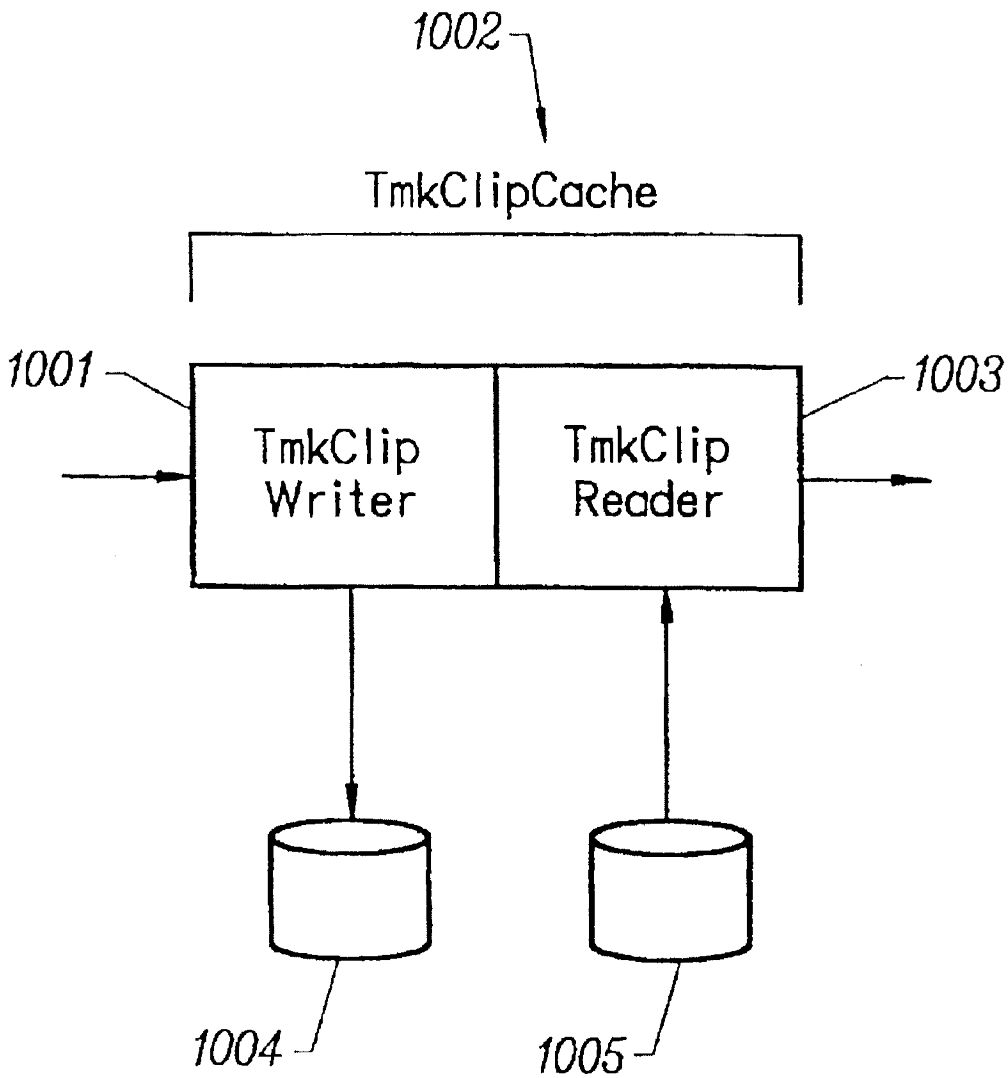

1002
TmkClipCache
1001
TmkClip
Writer
TmkClip
Reader
1003
1004
1005

FIG. 10

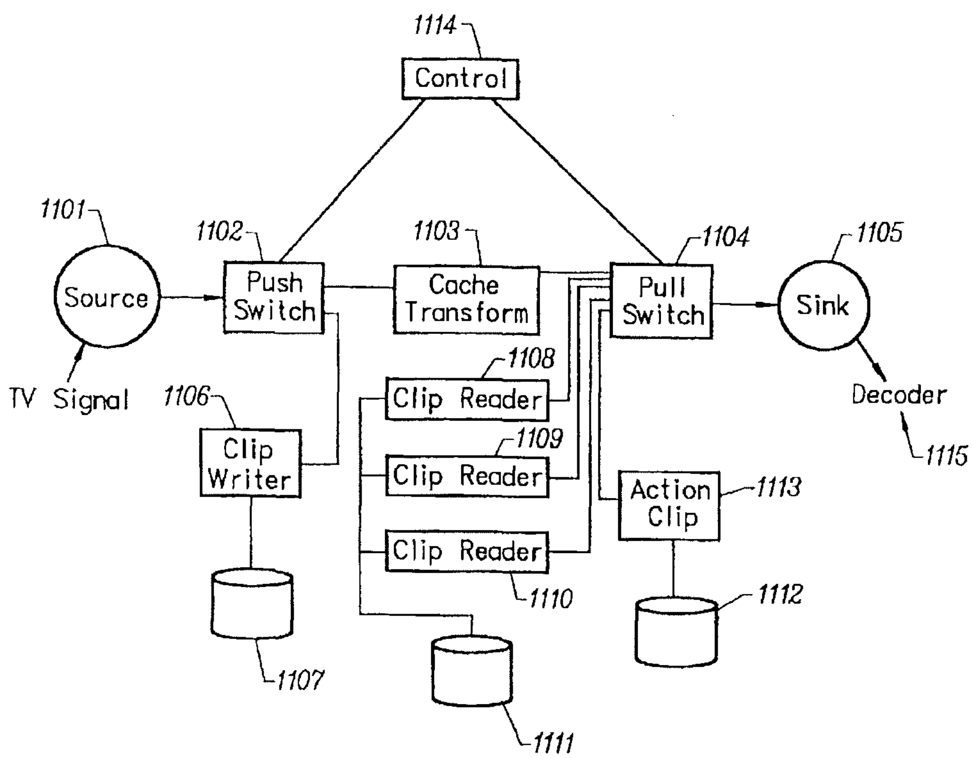

1114
Control
1101
1102
1103
1104
1105
Source
Push Switch
Cache Transform
Pull Switch
Sink
TV Signal
1106
1108
Clip Reader
1109
Clip Reader
Clip Reader
1110
Clip Writer
Action Clip
1113
Decoder
1115
1112
1107
1111

FIG. 11

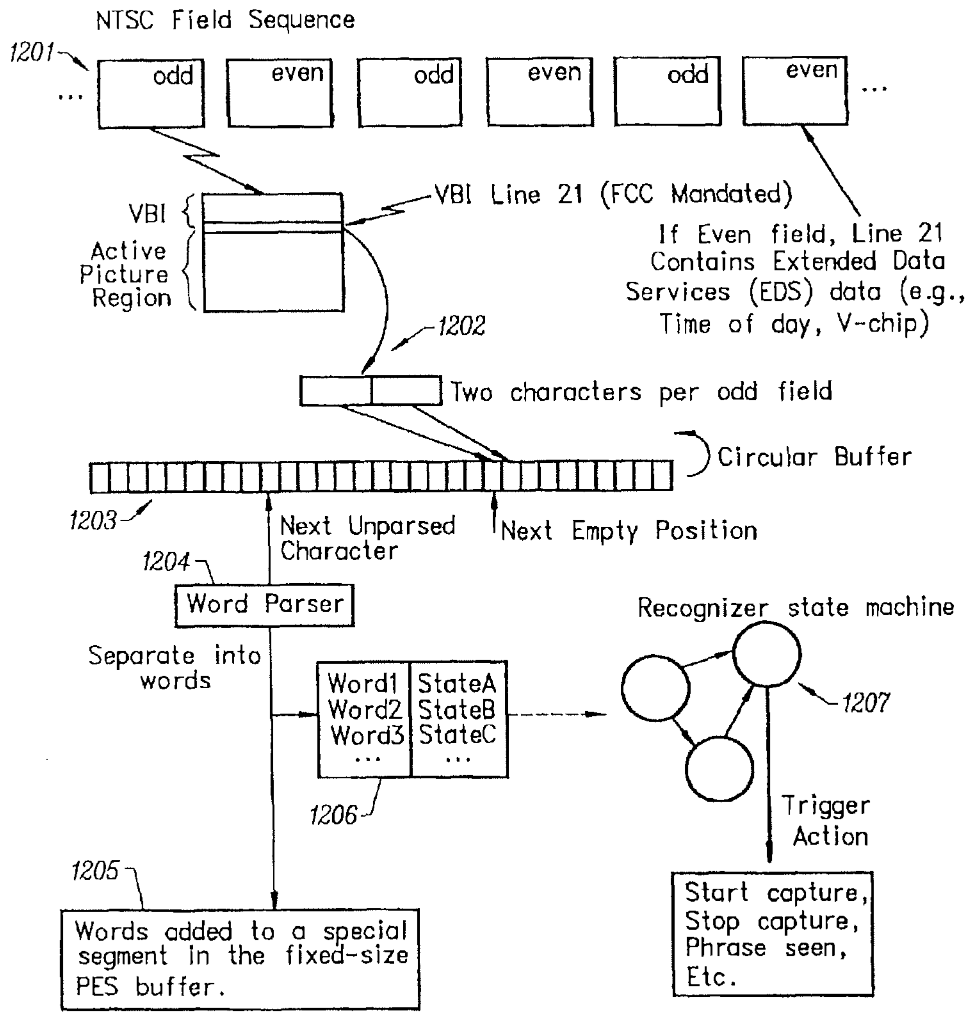

NTSC Field Sequence
1201
odd
even
odd
even
odd
even
VBI
Active Picture Region
VBI Line 21 (FCC Mandated)
If Even field, Line 21 Contains Extended Data Services (EDS) data (e.g., Time of day, V-chip)
1202
Two characters per odd field
Circular Buffer
1203
Next Unparsed Character
Next Empty Position
1204
Word Parser
Recognizer state machine
Separate into words
Word1
Word2
Word3
StateA
StateB
StateC
1207
1206
Trigger Action
1205
Words added to a special segment in the fixed-size PES buffer.
Start capture, Stop capture, Phrase seen, Etc.

FIG. 12

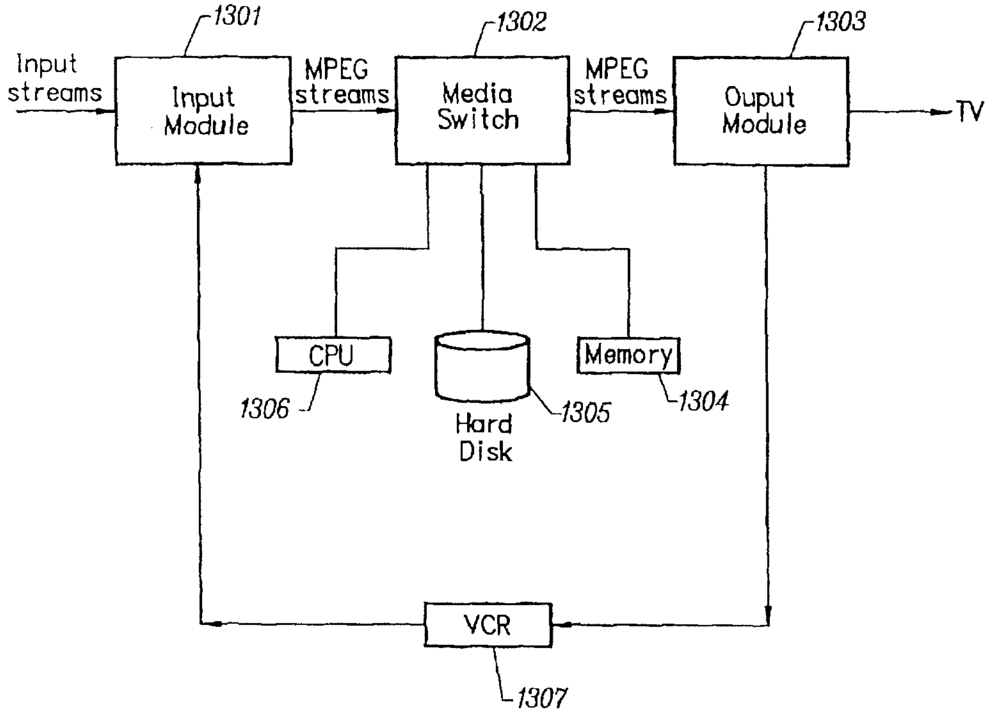

1301
1302
1303
Input streams
Input Module
MPEG streams
Media Switch
MPEG streams
Ouput Module
TV
CPU
Hard Disk
Memory
1306
1305
1304
VCR
1307

FIG. 13

MULTIMEDIA TIME WARPING SYSTEM

BACKGROUND OF THE INVENTION

1. Technical Field

The invention relates to the time shifting of television broadcast signals. More particularly, the invention relates to the real time capture, storage, and display of television broadcast signals.

2. Description of the Prior Art

The Video Cassette Recorder (VCR) has changed the lives of television (TV) viewers throughout the world. The VCR has offered viewers the flexibility to time-shift TV programs to match their lifestyles.

The viewer stores TV programs onto magnetic tape using the VCR. The VCR gives the viewer the ability to play, rewind, fast forward and pause the stored program material. These functions enable the viewer to pause the program playback whenever he desires, fast forward through unwanted program material or commercials, and to replay favorite scenes. However, a VCR cannot both capture and play back information at the same time.

One approach to solving this problem is to use several VCRs. For example, if two video tape recorders are available, it might be possible to Ping-Pong between the two. In this case, the first recorder is started at the beginning of the program of interest. If the viewer wishes to rewind the broadcast, the second recorder begins recording, while the first recorder is halted, rewound to the appropriate place, and playback initiated. However, at least a third video tape recorder is required if the viewer wishes to fast forward to some point in time after the initial rewind was requested. In this case, the third recorder starts recording the broadcast stream while the second is halted and rewound to the appropriate position. Continuing this exercise, one can quickly see that the equipment becomes unwieldy, unreliable, expensive, and hard to operate, while never supporting all desired functions. In addition, tapes are of finite length, and may potentially end at inconvenient times, drastically lowering the value of the solution.

The use of digital computer systems to solve this problem has been suggested. U.S. Pat. No. 5,371,551 issued to Logan et al., on Dec. 6, 1994, teaches a method for concurrent video recording and playback. It presents a microprocessor controlled broadcast and playback device. Said device compresses and stores video data onto a hard disk. However, this approach is difficult to implement because the processor requirements for keeping up with the high video rates makes the device expensive and problematic. The microprocessor must be extremely fast to keep up with the incoming and outgoing video data.

It would be advantageous to provide a multimedia time warping system that gives the user the ability to simultaneously record and play back TV broadcast programs. It would further be advantageous to provide a multimedia time warping system that utilizes an approach that decouples the microprocessor from the high video data rates, thereby reducing the microprocessor and system requirements which are at a premium.

SUMMARY OF THE INVENTION

The invention provides a multimedia time warping system. The invention utilizes an easily manipulated, low cost multimedia storage and display system that allows the user to view a television broadcast program with the option of instantly reviewing previous scenes within the program. In addition, the invention allows the user to store selected television broadcast programs while the user is simultaneously watching or reviewing another program.

A preferred embodiment of the invention accepts television (TV) input streams in a multitude of forms, for example, analog forms such as National Television Standards Committee (NTSC) or PAL broadcast, and digital forms such as Digital Satellite System (DSS), Digital Broadcast Services (DBS), or Advanced Television Standards Committee (ATSC). Analog TV streams are converted to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation, while pre-formatted MPEG streams are extracted from the digital TV signal and presented in a similar format to encoded analog streams.

The invention parses the resulting MPEG stream and separates it into its video and audio components. It then stores the components into temporary buffers. Events are recorded that indicate the type of component that has been found, where it is located, and when it occurred. The program logic is notified that an event has occurred and the data is extracted from the buffers.

The parser and event buffer decouple the CPU from having to parse the MPEG stream and from the real time nature of the data streams. This decoupling allows for slower CPU and bus speeds which translate to lower system costs. The video and audio components are stored on a storage device. When the program is requested for display, the video and audio components are extracted from the storage device and reassembled into an MPEG stream. The MPEG stream is sent to a decoder. The decoder converts the MPEG stream into TV output signals and delivers the TV output signals to a TV receiver.

User control commands are accepted and sent through the system. These commands affect the flow of said MPEG stream and allow the user to view stored programs with at least the following functions: reverse, fast forward, play, pause, index, fast/slow reverse play, and fast/slow play.

Other aspects and advantages of the invention will become apparent from the following detailed description in combination with the accompanying drawings, illustrating, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block schematic diagram of a high level view of a preferred embodiment of the invention according to the invention;

FIG. 2 is a block schematic diagram of a preferred embodiment of the invention using multiple input and output modules according to the invention;

FIG. 3 is a schematic diagram of an Moving Pictures Experts Group (MPEG) data stream and its video and audio components according to the invention;

FIG. 4 is a block schematic diagram of a parser and four direct memory access (DMA) input engines contained in the Media Switch according to the invention;

FIG. 5 is a schematic diagram of the components of a packetized elementary stream (PES) buffer according to the invention;

FIG. 6 is a schematic diagram of the construction of a PES buffer from the parsed components in the Media Switch output circular buffers;

FIG. 7 is a block schematic diagram of the Media Switch and the various components that it communicates with according to the invention;

FIG. 8 is a block schematic diagram of a high level view of the program logic according to the invention;

FIG. 9 is a block schematic diagram of a class hierarchy of the program logic according to the invention;

FIG. 10 is a block schematic diagram of a preferred embodiment of the clip cache component of the invention according to the invention;

FIG. 11 is a block schematic diagram of a preferred embodiment of the invention that emulates a broadcast studio video mixer according to the invention;

FIG. 12 is a block schematic diagram of a closed caption parser according to the invention; and

FIG. 13 is a block schematic diagram of a high level view of a preferred embodiment of the invention utilizing a VCR as an integral component of the invention according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention is embodied in a multimedia time warping system. A system according to the invention provides a multimedia storage and display system that allows the user to view a television broadcast program with the option of instantly reviewing previous scenes within the program. The invention additionally provides the user with the ability to store selected television broadcast programs while simultaneously watching or reviewing another program and to view stored programs with at least the following functions: reverse, fast forward, play, pause, index, fast/slow reverse play, and fast/slow play.

Referring to FIG. 1, a preferred embodiment of the invention has an Iuput Section 101, Media Switch 102, and an Output Section 103. The Input Section 101 takes television (TV) input streams in a multitude of forms, for example, National Television Standards Committee (NTSC) or PAL broadcast, and digital forms such as Digital Satellite System (DSS), Digital Broadcast Services (DBS), or Advanced Television Standards Committee (ATSC). DBS, DSS and ATSC are based on standards called Moving Pictures Experts Group 2 (MPEG2) and MPEG2 Transport. MPEG2 Transport is a standard for formatting the digital data stream from the TV source transmitter so that a TV receiver can disassemble the input stream to find programs in the multiplexed signal. The Input Section 101 produces MPEG streams. An MPEG2 transport multiplex supports multiple programs in the same broadcast channel, with multiple video and audio feeds and private data. The Input Section 101 tunes the channel to a particular program, extracts a specific MPEG program out of it, and feeds it to the rest of the system. Analog TV signals are encoded into a similar MPEG format using separate video and audio encoders, such that the remainder of the system is unaware of how the signal was obtained. Information may be modulated into the Vertical Blanking Interval (VBI) of the analog TV signal in a number of standard ways; for example, the North American Broadcast Teletext Standard (NABTS) may be used to modulate information onto lines 10 through 20 of an NTSC signal, while the FCC mandates the use of line 21 for Closed Caption (CC) and Extended Data Services (EDS). Such signals are decoded by the input section and passed to the other sections as if they were delivered via an MPEG2 private data channel.

The Media Switch 102 mediates between a microprocessor CPU 106, hard disk or storage device 105, and memory 104. Input streams are converted to an MPEG stream and sent to the Media Switch 102. The Media Switch 102 buffers the MPEG stream into memory. It then performs two operations if the user is watching real time TV: the stream is sent to the Output Section 103 and it is written simultaneously to the hard disk or storage device 105.

The Output Section 103 takes MPEG streams as input and produces an analog TV signal according to the NTSC, PAL, or other required TV standards. The Output Section 103 contains an MPEG decoder, On-Screen Display (OSD) generator, analog TV encoder and audio logic. The OSD generator allows the program logic to supply images which will be overlayed on top of the resulting analog TV signal. Additionally, the Output Section can modulate information supplied by the program logic onto the VBI of the output signal in a number of standard formats, including NABTS, CC and EDS.

With respect to FIG. 2, the invention easily expands to accommodate multiple Input Sections (tuners) 201, 202, 203, 204, each can be tuned to different types of input. Multiple Output Modules (decoders) 206, 207, 208, 209 are added as well. Special effects such as picture in a picture can be implemented with multiple decoders. The Media Switch 205 records one program while the user is watching another. This means that a stream can be extracted off the disk while another stream is being stored onto the disk.

Referring to FIG. 3, the incoming MPEG stream 301 has interleaved video 302, 305, 306 and audio 303, 304, 307 segments. These elements must be separated and recombined to create separate video 308 and audio 309 streams or buffers. This is necessary because separate decoders are used to convert MPEG elements back into audio or video analog components. Such separate delivery requires that time sequence information be generated so that the decoders may be properly synchronized for accurate playback of the signal.

The Media Switch enables the program logic to associate proper time sequence information with each segment, possibly embedding it directly into the stream. The time sequence information for each segment is called a time stamp. These time stamps are monotonically increasing and start at zero each time the system boots up. This allows the invention to find any particular spot in any particular video segment. For example, if the system needs to read five seconds into an incoming contiguous video stream that is being cached, the system simply has to start reading forward into the stream and look for the appropriate time stamp.

A binary search can be performed on a stored file to index into a stream. Each stream is stored as a sequence of fixed-size segments enabling fast binary searches because of the uniform time stamping. If the user wants to start in the middle of the program, the system performs a binary search of the stored segments until it finds the appropriate spot, obtaining the desired results with a minimal amount of information. If the signal were instead stored as an MPEG stream, it would be necessary to linearly parse the stream from the beginning to find the desired location.

With respect to FIG. 4, the Media Switch contains four input Direct Memory Access (DMA) engines 402, 403, 404, 405 each DMA engine has an associated buffer 410, 411, 412, 413. Conceptually, each DMA engine has a pointer 406, a limit for that pointer 407, a next pointer 408, and a limit for the next pointer 409. Each DMA engine is dedicated to a particular type of information, for example, video 402, audio 403, and parsed events 405. The buffers 410, 411, 412, 413 are circular and collect the specific information. The DMA engine increments the pointer 406 into the associated buffer until it reaches the limit 407 and then loads the next pointer 408 and limit 409. Setting the pointer 406 and next pointer 408 to the same value, along with the corresponding

limit value creates a circular buffer. The next pointer **408** can be set to a different address to provide vector DMA.

The input stream flows through a parser **401**. The parser **401** parses the stream looking for MPEG distinguished events indicating the start of video, audio or private data segments. For example, when the parser **401** finds a video event, it directs the stream to the video DMA engine **402**. The parser **401** buffers up data and DMAs it into the video buffer **410** through the video DMA engine **402**. At the same time, the parser **401** directs an event to the event DMA engine **405** which generates an event into the event buffer **413**. When the parser **401** sees an audio event, it redirects the byte stream to the audio DMA engine **403** and generates an event into the event buffer **413**. Similarly, when the parser **401** sees a private data event, it directs the byte stream to the private data DMA engine **404** and directs an event to the event buffer **413**. The Media Switch notifies the program logic via an interrupt mechanism when events are placed in the event buffer.

Referring to FIGS. **4** and **5**, the event buffer **413** is filled by the parser **401** with events. Each event **501** in the event buffer has an offset **502**, event type **503**, and time stamp field **504**. The parser **401** provides the type and offset of each event as it is placed into the buffer. For example, when an audio event occurs, the event type field is set to an audio event and the offset indicates the location in the audio buffer **411**. The program logic knows where the audio buffer **411** starts and adds the offset to find the event in the stream. The address offset **502** tells the program logic where the next event occurred, but not where it ended. The previous event is cached so the end of the current event can be found as well as the length of the segment.

With respect to FIGS. **5** and **6**, the program logic reads accumulated events in the event buffer **602** when it is interrupted by the Media Switch **601**. From these events the program logic generates a sequence of logical segments **603** which correspond to the parsed MPEG segments **615**. The program logic converts the offset **502** into the actual address **610** of each segment, and records the event length **609** using the last cached event. If the stream was produced by encoding an analog signal, it will not contain Program Time Stamp (PTS) values, which are used by the decoders to properly present the resulting output. Thus, the program logic uses the generated time stamp **504** to calculate a simulated PTS for each segment and places that into the logical segment time stamp **607**. In the case of a digital TV stream, PTS values are already encoded in the stream. The program logic extracts this information and places it in the logical segment time stamp **607**.

The program logic continues collecting logical segments **603** until it reaches the fixed buffer size. When this occurs, the program logic generates a new buffer, called a Packetized Elementary Stream (PES) **605** buffer containing these logical segments **603** in order, plus ancillary control information. Each logical segment points **604** directly to the circular buffer, e.g., the video buffer **613**, filled by the Media Switch **601**. This new buffer is then passed to other logic components, which may further process the stream in the buffer in some way, such as presenting it for decoding or writing it to the storage media. Thus, the MPEG data is not copied from one location in memory to another by the processor. This results in a more cost effective design since lower memory bandwidth and processor bandwidth is required.

A unique feature of the MPEG stream transformation into PES buffers is that the data associated with logical segments

need not be present in the buffer itself, as presented above. When a PES buffer is written to storage, these logical segments are written to the storage medium in the logical order in which they appear. This has the effect of gathering components of the stream, whether they be in the video, audio or private data circular buffers, into a single linear buffer of stream data on the storage medium. The buffer is read back from the storage medium with a single transfer from the storage media, and the logical segment information is updated to correspond with the actual locations in the buffer **606**. Higher level program logic is unaware of this transformation, since it handles only the logical segments, thus stream data is easily managed without requiring that the data ever be copied between locations in DRAM by the CPU.

A unique aspect of the Media Switch is the ability to handle high data rates effectively and inexpensively. It performs the functions of taking video and audio data in, sending video and audio data out, sending video and audio data to disk, and extracting video and audio data from the disk on a low cost platform. Generally, the Media Switch runs asynchronously and autonomously with the microprocessor CPU, using its DMA capabilities to move large quantities of information with minimal intervention by the CPU.

Referring to FIG. **7**, the input side of the Media Switch **701** is connected to an MPEG encoder **703**. There are also circuits specific to MPEG audio **704** and vertical blanking interval (VBI) data **702** feeding into the Media Switch **701**. If a digital TV signal is being processed instead, the MPEG encoder **703** is replaced with an MPEG2 Transport Demultiplexor, and the MPEG audio encoder **704** and VBI decoder **702** are deleted. The demultiplexor multiplexes the extracted audio, video and private data channel streams through the video input Media Switch port.

The parser **705** parses the input data stream from the MPEG encoder **703**, audio encoder **704** and VBI decoder **702**, or from the transport demultiplexor in the case of a digital TV stream. The parser **705** detects the beginning of all of the important events in a video or audio stream, the start of all of the frames, the start of sequence headers—all of the pieces of information that the program logic needs to know about in order to both properly play back and perform special effects on the stream, e.g. fast forward, reverse, play, pause, fast/slow play, indexing, and fast/slow reverse play.

The parser **705** places tags **707** into the FIFO **706** when it identifies video or audio segments, or is given private data. The DMA **709** controls when these tags are taken out. The tags **707** and the DMA addresses of the segments are placed into the event queue **708**. The frame type information, whether it is a start of a video I-frame, video B-frame, video P-frame, video PES, audio PES, a sequence header, an audio frame, or private data packet, is placed into the event queue **708** along with the offset in the related circular buffer where the piece of information was placed. The program logic operating in the CPU **713** examines events in the circular buffer after it is transferred to the DRAM **714**.

The Media Switch **701** has a data bus **711** that connects to the CPU **713** and DRAM **714**. An address bus **712** is also shared between the Media Switch **701**, CPU **713**, and DRAM **714**. A hard disk or storage device **710** is connected to one of the ports of the Media Switch **701**. The Media Switch **701** outputs streams to an MPEG video decoder **715** and a separate audio decoder **717**. The audio decoder **717** signals contain audio cues generated by the system in response to the user's commands on a remote control or

other internal events. The decoded audio output from the MPEG decoder is digitally mixed 718 with the separate audio signal. The resulting signals contain video, audio, and on-screen displays and are sent to the TV 716.

The Media Switch 701 takes in 8-bit data and sends it to the disk, while at the same time extracts another stream of data off of the disk and sends it to the MPEG decoder 715. All of the DMA engines described above can be working at the same time. The Media Switch 701 can be implemented in hardware using a Field Programmable Gate Array (FPGA), ASIC, or discrete logic.

Rather than having to parse through an immense data stream looking for the start of where each frame would be, the program logic only has to look at the circular event buffer in DRAM 714 and it can tell where the start of each frame is and the frame type. This approach saves a large amount of CPU power, keeping the real time requirements of the CPU 713 small. The CPU 713 does not have to be very fast at any point in time. The Media Switch 701 gives the CPU 713 as much time as possible to complete tasks. The parsing mechanism 705 and event queue 708 decouple the CPU 713 from parsing the audio, video, and buffers and the real time nature of the streams, which allows for lower costs. It also allows the use of a bus structure in a CPU environment that operates at a much lower clock rate with much cheaper memory than would be required otherwise.

The CPU 713 has the ability to queue up one DMA transfer and can set up the next DMA transfer at its leisure. This gives the CPU 713 large time intervals within which it can service the DMA controller 709. The CPU 713 may respond to a DMA interrupt within a larger time window because of the large latency allowed. MPEG streams, whether extracted from an MPEG2 Transport or encoded from an analog TV signal, are typically encoded using a technique called Variable Bit Rate encoding (VBR). This technique varies the amount of data required to represent a sequence of images by the amount of movement between those images. This technique can greatly reduce the required bandwidth for a signal, however sequences with rapid movement (such as a basketball game) may be encoded with much greater bandwidth requirements. For example, the Hughes DirecTV satellite system encodes signals with anywhere from 1 to 10 Mb/s of required bandwidth, varying from frame to frame. It would be difficult for any computer system to keep up with such rapidly varying data rates without this structure.

With respect to FIG. 8, the program logic within the CPU has three conceptual components: sources 801, transforms 802, and sinks 803. The sources 801 produce buffers of data. Transforms 802 process buffers of data and sinks 803 consume buffers of data. A transform is responsible for allocating and queuing the buffers of data on which it will operate. Buffers are allocated as if "empty" to sources of data, which give them back "full". The buffers are then queued and given to sinks as "full", and the sink will return the buffer "empty".

A source 801 accepts data from encoders, e.g., a digital satellite receiver. It acquires buffers for this data from the downstream transform, packages the data into a buffer, then pushes the buffer down the pipeline as described above. The source object 801 does not know anything about the rest of the system. The sink 803 consumes buffers, taking a buffer from the upstream transform, sending the data to the decoder, and then releasing the buffer for reuse.

There are two types of transforms 802 used: spatial and temporal. Spatial transforms are transforms that perform, for example, an image convolution or compression/decompression on the buffered data that is passing through. Temporal transforms are used when there is no time relation that is expressible between buffers going in and buffers coming out of a system. Such a transform writes the buffer to a file 804 on the storage medium. The buffer is pulled out at a later time, sent down the pipeline, and properly sequenced within the stream.

Referring to FIG. 9, a C++ class hierarchy derivation of the program logic is shown. The TiVo Media Kernel (Tmk) 904, 908, 913 mediates with the operating system kernel. The kernel provides operations such as: memory allocation, synchronization, and threading. The TmkCore 904, 908, 913 structures memory taken from the media kernel as an object. It provides operators, new and delete, for constructing and deconstructing the object. Each object (source 901, transform 902, and sink 903) is multi-threaded by definition and can run in parallel.

The TmkPipeline class 905, 909, 914 is responsible for flow control through the system. The pipelines point to the next pipeline in the flow from source 901 to sink 903. To pause the pipeline, for example, an event called "pause" is sent to the first object in the pipeline. The event is relayed on to the next object and so on down the pipeline. This all happens asynchronously to the data going through the pipeline. Thus, similar to applications such as telephony, control of the flow of MPEG streams is asynchronous and separate from the streams themselves. This allows for a simple logic design that is at the same time powerful enough to support the features described previously, including pause, rewind, fast forward and others. In addition, this structure allows fast and efficient switching between stream sources, since buffered data can be simply discarded and decoders reset using a single event, after which data from the new stream will pass down the pipeline. Such a capability is needed, for example, when switching the channel being captured by the input section, or when switching between a live signal from the input section and a stored stream.

The source object 901 is a TmkSource 906 and the transform object 902 is a TmkXfrm 910. These are intermediate classes that define standard behaviors for the classes in the pipeline. Conceptually, they handshake buffers down the pipeline. The source object 901 takes data out of a physical data source, such as the Media Switch, and places it into a PES buffer. To obtain the buffer, the source object 901 asks the down stream object in his pipeline for a buffer (allocEmptyBuf). The source object 901 is blocked until there is sufficient memory. This means that the pipeline is self-regulating; it has automatic flow control. When the source object 901 has filled up the buffer, it hands it back to the transform 902 through the pushFullBuf function.

The sink 903 is flow controlled as well. It calls nextFullBuf which tells the transform 902 that it is ready for the next filled buffer. This operation can block the sink 903 until a buffer is ready. When the sink 903 is finished with a buffer (i.e., it has consumed the data in the buffer) it calls releaseEmptyBuf. ReleaseEmptyBuf gives the buffer back to the transform 902. The transform 902 can then hand that buffer, for example, back to the source object 901 to fill up again. In addition to the automatic flow-control benefit of this method, it also provides for limiting the amount of memory dedicated to buffers by allowing enforcement of a fixed allocation of buffers by a transform. This is an important feature in achieving a cost-effective limited DRAM environment.

The MediaSwitch class 909 calls the allocEmptyBuf method of the TmkClipCache 912 object and receives a PES

buffer from it. It then goes out to the circular buffers in the Media Switch hardware and generates PES buffers. The MediaSwitch class **909** fills the buffer up and pushes it back to the TmkClipCache **912** object.

The TmkClipCache **912** maintains a cache file **918** on a storage medium. It also maintains two pointers into this cache: a push pointer **919** that shows where the next buffer coming from the source **901** is inserted; and a current pointer **920** which points to the current buffer used.

The buffer that is pointed to by the current pointer is handed to the Vela decoder class **916**. The Vela decoder class **916** talks to the decoder **921** in the hardware. The decoder **921** produces a decoded TV signal that is subsequently encoded into an analog TV signal in NTSC, PAL or other analog format. When the Vela decoder class **916** is finished with the buffer it calls releaseEmptyBuf.

The structure of the classes makes the system easy to test and debug. Each level can be tested separately to make sure it performs in the appropriate manner, and the classes may be gradually aggregated to achieve the desired functionality while retaining the ability to effectively test each object.

The control object **917** accepts commands from the user and sends events into the pipeline to control what the pipeline is doing. For example, if the user has a remote control and is watching TV, the user presses pause and the control object **917** sends an event to the sink **903**, that tells it pause. The sink **903** stops asking for new buffers. The current pointer **920** stays where it is at. The sink **903** starts taking buffers out again when it receives another event that tells it to play. The system is in perfect synchronization; it starts from the frame that it stopped at.

The remote control may also have a fast forward key. When the fast forward key is pressed, the control object **917** sends an event to the transform **902**, that tells it to move forward two seconds. The transform **902** finds that the two second time span requires it to move forward three buffers. It then issues a reset event to the downstream pipeline, so that any queued data or state that may be present in the hardware decoders is flushed. This is a critical step, since the structure of MPEG streams requires maintenance of state across multiple frames of data, and that state will be rendered invalid by repositioning the pointer. It then moves the current pointer **920** forward three buffers. The next time the sink **903** calls nextFullBuf it gets the new current buffer. The same method works for fast reverse in that the transform **902** moves the current pointer **920** backwards.

A system clock reference resides in the decoder. The system clock reference is sped up for fast play or slowed down for slow play. The sink simply asks for full buffers faster or slower, depending on the clock speed.

With respect to FIG. **10**, two other objects derived from the TmkXfrm class are placed in the pipeline for disk access. One is called TmkClipReader **1003** and the other is called TmkClipWriter **1001**. Buffers come into the TmkClipWriter **1001** and are pushed to a file on a storage medium **1004**. TmkClipReader **1003** asks for buffers which are taken off of a file on a storage medium **1005**. A TmkClipReader **1003** provides only the allocEmptyBuf and pushFullBuf methods, while a TmkClipWriter **1001** provides only the nextFullBuf and releaseEmptyBuf methods. A TmkClipReader **1003** therefore performs the same function as the input, or "push" side of a TmkClipCache **1002**, while a TmkClipWriter **1001** therefore performs the same function as the output, or "pull" side of a TmkClipCache **1002**.

Referring to FIG. **11**, a preferred embodiment that accomplishes multiple functions is shown. A source **1101** has a TV signal input. The source sends data to a PushSwitch **1102** which is a transform derived from TmkXfrm. The PushSwitch **1102** has multiple outputs that can be switched by the control object **1114**. This means that one part of the pipeline can be stopped and another can be started at the users whim. The user can switch to different storage devices. The PushSwitch **1102** could output to a TmkClipWriter **1106**, which goes onto a storage device **1107** or write to the cache transform **1103**.

An important feature of this apparatus is the ease with which it can selectively capture portions of an incoming signal under the control of program logic. Based on information such as the current time, or perhaps a specific time span, or perhaps via a remote control button press by the viewer, a TmkClipWriter **1106** may be switched on to record a portion of the signal, and switched off at some later time. This switching is typically caused by sending a "switch" event to the PushSwitch **1102** object.

An additional method for triggering selective capture is through information modulated into the VBI or placed into an MPEG private data channel. Data decoded from the VBI or private data channel is passed to the program logic. The program logic examines this data to determine if the data indicates that capture of the TV signal into which it was modulated should begin. Similarly, this information may also indicate when recording should end, or another data item may be modulated into the signal indicating when the capture should end. The starting and ending indicators may be explicitly modulated into the signal or other information that is placed into the signal in a standard fashion may be used to encode this information.

With respect to FIG. **12**, an example is shown which demonstrates how the program logic scans the words contained within the closed caption (CC) fields to determine starting and ending times, using particular words or phrases to trigger the capture. A stream of NTSC or PAL fields **1201** is presented. CC bytes are extracted from each odd field **1202**, and entered in a circular buffer **1203** for processing by the Word Parser **1204**. The Word Parser **1204** collects characters until it encounters a word boundary, usually a space, period or other delineating character. Recall from above, that the MPEG audio and video segments are collected into a series of fixed-size PES buffers. A special segment is added to each PES buffer to hold the words extracted from the CC field **1205**. Thus, the CC information is preserved in time synchronization with the audio and video, and can be correctly presented to the viewer when the stream is displayed. This also allows the stored stream to be processed for CC information at the leisure of the program logic, which spreads out load, reducing cost and improving efficiency. In such a case, the words stored in the special segment are simply passed to the state table logic **1206**.

During stream capture, each word is looked up in a table **1206** which indicates the action to take on recognizing that word. This action may simply change the state of the recognizer state machine **1207**, or may cause the state machine **1207** to issue an action request, such as "start capture", "stop capture", "phrase seen", or other similar requests. Indeed, a recognized word or phrase may cause the pipeline to be switched; for example, to overlay a different audio track if undesirable language is used in the program.

Note that the parsing state table **1206** and recognizer state machine **1207** may be modified or changed at any time. For example, a different table and state machine may be provided for each input channel. Alternatively, these elements may be switched depending on the time of day, or because of other events.

Referring to FIG. **11**, a PullSwitch is added **1104** which outputs to the sink **1105**.

The sink **1105** calls nextFullBuf and releaseEmptyBuf to get or return buffers from the PullSwitch **1104**. The PullSwitch **1104** can have any number of inputs. One input could be an ActionClip **1113**. The remote control can switch between input sources. The control object **1114** sends an event to the PullSwitch **1104**, telling it to switch. It will switch from the current input source to whatever input source the control object selects.

An ActionClip class provides for sequencing a number of different stored signals in a predictable and controllable manner, possibly with the added control of viewer selection via a remote control. Thus, it appears as a derivative of a TmkXfrm object that accepts a "switch" event for switching to the next stored signal.

This allows the program logic or user to create custom sequences of video output. Any number of video segments can be lined up and combined as if the program logic or user were using a broadcast studio video mixer. TmkClipReaders **1108, 1109, 1110** are allocated and each is hooked into the PullSwitch **1104**. The PullSwitch **1104** switches between the TmkClipReaders **1108, 1109, 1110** to combine video and audio clips. Flow control is automatic because of the way the pipeline is constructed. The Push and Pull Switches are the same as video switches in a broadcast studio.

The derived class and resulting objects described here may be combined in an arbitrary way to create a number of different useful configurations for storing, retrieving, switching and viewing of TV streams. For example, if multiple input and output sections are available, one input is viewed while another is stored, and a picture-in-picture window generated by the second output is used to preview previously stored streams. Such configurations represent a unique and novel application of software transformations to achieve the functionality expected of expensive, sophisticated hardware solutions within a single cost-effective device.

With respect to FIG. **13**, a high-level system view is shown which implements a VCR backup. The Output Module **1303** sends TV signals to the VCR **1307**. This allows the user to record TV programs directly on to video tape. The invention allows the user to queue up programs from disk to be recorded on to video tape and to schedule the time that the programs are sent to the VCR **1307**. Title pages (EPG data) can be sent to the VCR **1307** before a program is sent. Longer programs can be scaled to fit onto smaller video tapes by speeding up the play speed or dropping frames.

The VCR **1307** output can also be routed back into the Input Module **1301**. In this configuration the VCR acts as a backup system for the Media Switch **1302**. Any overflow storage or lower priority programming is sent to the VCR **1307** for later retrieval.

The Input Module **1301** can decode and pass to the remainder of the system information encoded on the Vertical Blanking Interval (VBI). The Output Module **1303** can encode into the output VBI data provided by the remainder of the system. The program logic may arrange to encode identifying information of various kinds into the output signal, which will be recorded onto tape using the VCR **1307**. Playing this tape back into the input allows the program logic to read back this identifying information, such that the TV signal recorded on the tape is properly handled. For example, a particular program may be recorded to tape along with information about when it was recorded, the source network, etc. When this program is played back into the Input Module, this information can be used to control storage of the signal, presentation to the viewer, etc.

One skilled in the art will readily appreciate that such a mechanism may be used to introduce various data items to the program logic which are not properly conceived of as television signals. For instance, software updates or other data may be passed to the system. The program logic receiving this data from the television stream may impose controls on how the data is handled, such as requiring certain authentication sequences and/or decrypting the embedded information according to some previously acquired key. Such a method works for normal broadcast signals as well, leading to an efficient means of providing non-TV control information and data to the program logic.

Additionally, one skilled in the art will readily appreciate that although a VCR is specifically mentioned above, any multimedia recording device (e.g., a Digital Video Disk-Random Access Memory (DVD-RAM) recorder) is easily substituted in its place.

Although the invention is described herein with reference to the preferred embodiment, one skilled in the art will readily appreciate that other applications may be substituted for those set forth herein without departing from the spirit and scope of the present invention. For example, the invention can be used in the detection of gambling casino crime. The input section of the invention is connected to the casino's video surveillance system. Recorded video is cached and simultaneously output to external VCRs. The user can switch to any video feed and examine (i.e., rewind, play, slow play, fast forward, etc.) a specific segment of the recorded video while the external VCRs are being loaded with the real-time input video. Accordingly, the invention should only be limited by the claims included below.

What is claimed is:

1. A process for the simultaneous storage and play back of multimedia data, comprising the steps of:

accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards, including, but not limited to, National Television Standards Committee (NTSC) broadcast, PAL broadcast, satellite transmission, DSS, DBS, or ATSC;

tuning said TV signals to a specific program;

providing at least one Input Section, wherein said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation;

providing a Media Switch, wherein said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components;

storing said video and audio components on a storage device;

providing at least one Output Section, wherein said Output Section extracts said video and audio components from said storage device;

wherein said Output Section assembles said video and audio components into an MPEG stream;

wherein said Output Section sends said MPEG stream to a decoder;

wherein said decoder converts said MPEG stream into TV output signals;

wherein said decoder delivers said TV output signals to a TV receiver; and

accepting control commands from a user, wherein said control commands are sent through the system and affect the flow of said MPEG stream.

2. The process of claim 1, wherein said Input Section directs said MPEG stream to the destination indicated by said control commands.

3. The process of claim 1, wherein said Output Section extracts said video and audio components from the storage device indicated by said control commands.

4. The process of claim 1, further comprising the step of:

creating custom video output sequences, wherein said sequences are specified by a user or program control.

5. The process of claim 1, wherein the storing and extracting of said video and audio components from said storage device are performed simultaneously.

6. The process of claim 1, wherein said Media Switch calculates and logically associates a time stamp to said video and audio components.

7. The process of claim 1, wherein said Media Switch extracts time stamp values from a digital TV stream and logically associates said time stamp values to said video and audio components.

8. The process of claim 1, further comprising the steps of:

placing said video component into a circular video buffer;

posting an event in a circular event buffer, wherein said event contains an indication that a video component was found and the location of said video component in said circular video buffer; and

sending notice of said event posting.

9. The process of claim 1, further comprising the steps of:

placing said audio component into a circular audio buffer;

posting an event in a circular event buffer, wherein said event contains an indication that an audio component was found and the location of said audio component in said circular audio buffer; and

sending notice of said event posting.

10. The process of claims 8 or 9, further comprising the steps of:

receiving said notice;

retrieving said event posting from said event buffer; and

indexing into the appropriate buffer indicated by the type and location information in said event buffer.

11. The process of claim 10, further comprising the steps of:

generating a buffer containing the logical audio or video segments in order, including ancillary information, wherein each of said logical segments points to the appropriate circular buffer location where corresponding audio or video components have been placed.

12. The process of claim 1, further comprising the step of:

increasing the decoder system clock rate for fast playback or fast reverse playback.

13. The process of claim 1, further comprising the step of:

decreasing the decoder system clock rate for slow playback or slow reverse playback.

14. The process of claim 1, further comprising the step of:

combining system audio cues and on-screen displays with said TV output signals.

15. The process of claim 1, further comprising the steps of:

decoding the Vertical Blanking Interval (VBI) data or private data channel information from said TV signal; and

examining said data to determine the starting or ending indicators of a specific program.

16. The process of claim 1, further comprising the step of:

scanning the words contained within the closed caption (CC) fields to determine program starting and ending times, wherein particular words or phrases are used to trigger the recording of a specific program and wherein the CC information is preserved in time synchronization with the audio and video, and can be correctly presented to the viewer when the stream is displayed.

17. The process of claim 16, further comprising the step of:

performing a specific action when a specific word is found in said CC information.

18. The process of claim 1, wherein said Media Switch has a data bus connecting it to a CPU and DRAM.

19. The process of claim 1, wherein said Media Switch shares an address bus with a CPU and DRAM.

20. The process of claim 1, wherein said Media Switch operates asychronously and autonomously with a CPU.

21. The process of claim 1, wherein said storage device is connected to said Media Switch.

22. The process of claim 1, wherein said Media Switch allows the CPU to queue up Direct Memory Access (DMA) transfers.

23. The process of claim 1, wherein said Media Switch is implemented in hardware.

24. The process of claim 1, further comprising the step of:

providing a multimedia recording device, including, but not limited to, a Video Cassette Recorder (VCR) or a Digital Video Disk-Random Access Memory (DVD-RAM) device, wherein said recording device is attached to the output side of said decoder, allowing said user to record said TV output signals.

25. The process of claim 24, wherein said user queues up programs from said storage device to be stored on said recording device.

26. The process of claim 24, wherein said user sets time schedules for said programs to be sent to said recording device.

27. The process of claim 24, wherein title pages may be sent to said recording device before sending a program to be stored on said recording device.

28. The process of claim 24, wherein a program that is longer in duration than a magnetic tape in said recording device allows, is sped up to fit within the desired time limit.

29. The process of claim 24, wherein a program that is longer in duration than a magnetic tape in said recording device allows, has frames dropped from it to fit within the desired time limit.

30. The process of claim 24, wherein the output of said recording device is routed to said Input Section, allowing said recording device to act as a storage back up system, said recording device accepts overflow storage, TV programs, software updates, or other data that are later retrieved and sent to said Input Section.

31. A process for the simultaneous storage and play back of multimedia data, comprising the steps of:

providing a physical data source, wherein said physical data source accepts broadcast data from an input device, parses video and audio data from said broadcast data, and temporarily stores said video and audio data;

providing a source object, wherein said source object extracts video and audio data from said physical data source;

providing a transform object, wherein said transform object stores and retrieves data streams onto a storage device;

wherein said source object obtains a buffer from said transform object, said source object converts video data into data streams and fills said buffer with said streams;

wherein said source object is automatically flow controlled by said transform object;

providing a sink object, wherein said sink object obtains data stream buffers from said transform object and outputs said streams to a video and audio decoder;

wherein said decoder converts said streams into display signals and sends said signals to a display;

wherein said sink object is automatically flow controlled by said transform object;

providing a control object, wherein said control object receives commands from a user, said commands control the flow of the broadcast data through the system; and

wherein said control object sends flow command events to said source, transform, and sink objects.

32. An apparatus for the simultaneous storage and play back of multimedia data, comprising:

a module for accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards, including, but not limited to, National Television Standards Committee (NTSC) broadcast, PAL broadcast, satellite transmission, DSS, DBS, or ATSC;

a module for tuning said TV signals to a specific program;

at least one Input Section, wherein said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation;

a Media Switch, wherein said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components;

a module for storing said video and audio components on a storage device;

at least one Output Section, wherein said Output Section extracts said video and audio components from said storage device;

wherein said Output Section assembles said video and audio components into an MPEG stream;

wherein said Output Section sends said MPEG stream to a decoder;

wherein said decoder converts said MPEG stream into TV output signals;

wherein said decoder delivers said TV output signals to a TV receiver; and

accepting control commands from a user, wherein said control commands are sent through the system and affect the flow of said MPEG stream.

33. The apparatus of claim 32, wherein said Input Section directs said MPEG stream to the destination indicated by said control commands.

34. The apparatus of claim 32, wherein said Output Section extracts said video and audio components from the storage device indicated by said control commands.

35. The apparatus of claim 32, further comprising:

a module for creating custom video output sequences, wherein said sequences are specified by a user or program control.

36. The apparatus of claim 32, wherein the storing and extracting of said video and audio components from said storage device are performed simultaneously.

37. The apparatus of claim 32, wherein said Media Switch calculates and logically associates a time stamp to said video and audio components.

38. The apparatus of claim 32, wherein said Media Switch extracts time stamp values from a digital TV stream and logically associates said time stamp values to said video and audio components.

39. The apparatus of claim 32, further comprising:

a module for placing said video component into a circular video buffer;

a module for posting an event in a circular event buffer, wherein said event contains an indication that a video component was found and the location of said video component in said circular video buffer; and

a module for sending notice of said event posting.

40. The apparatus of claim 32, further comprising:

a module for placing said audio component into a circular audio buffer;

a module for posting an event in a circular event buffer, wherein said event contains an indication that an audio component was found and the location of said audio component in said circular audio buffer; and

a module for sending notice of said event posting.

41. The apparatus of claims 39 or 40, further comprising:

a module for receiving said notice;

a module for retrieving said event posting from said event buffer; and

a module for indexing into the appropriate buffer indicated by the type and location information in said event buffer.

42. The apparatus of claim 41, further comprising:

a module for generating a buffer containing the logical audio or video segments in order, including ancillary information, wherein each of said logical segments points to the appropriate circular buffer location where corresponding audio or video components have been placed.

43. The apparatus of claim 32, further comprising:

a module for increasing the decoder system clock rate for fast playback or fast reverse playback.

44. The apparatus of claim 32, further comprising:

a module for decreasing the decoder system clock rate for slow playback or slow reverse playback.

45. The apparatus of claim 32, further comprising:

a module for combining system audio cues and on-screen displays with said TV output signals.

46. The apparatus of claim 32, further comprising:

a module for decoding the Vertical Blanking Interval (VBI) data or private data channel information from said TV signal; and

a module for examining said data to determine the starting or ending indicators of a specific program.

47. The apparatus of claim 32, further comprising:

a module for scanning the words contained within the closed caption (CC) fields to determine program starting and ending times, wherein particular words or phrases are used to trigger the recording of a specific program and wherein the CC information is preserved in time synchronization with the audio and video, and can be correctly presented to the viewer when the stream is displayed.

48. The apparatus of claim 47, further comprising:

a module for performing a specific action when a specific word is found in said CC information.

49. The apparatus of claim 32, wherein said Media Switch has a data bus connecting it to a CPU and DRAM.

50. The apparatus of claim 32, wherein said Media Switch shares an address bus with a CPU and DRAM.

51. The apparatus of claim 32, wherein said Media Switch operates asychronously and autonomously with a CPU.

52. The apparatus of claim 32, wherein said storage device is connected to said Media Switch.

53. The apparatus of claim 32, wherein said Media Switch allows the CPU to queue up Direct Memory Access (DMA) transfers.

54. The apparatus of claim 32, further comprising:

a multimedia recording device, including, but not limited to, a Video Cassette Recorder (VCR) or a Digital Video Disk-Random Access Memory (DVD-RAM) device, wherein said recording device is attached to the output side of said decoder, allowing said user to record said TV output signals.

55. The apparatus of claim 54, wherein said user queues up programs from said storage device to be stored on said recording device.

56. The apparatus of claim 54, wherein said user sets time schedules for said programs to be sent to said recording device.

57. The apparatus of claim 54, wherein title pages may be sent to said recording device before sending a program to be stored on said recording device.

58. The apparatus of claim 54, wherein a program that is longer in duration than a magnetic tape in said recording device allows, is sped up to fit within the desired time limit.

59. The apparatus of claim 54, wherein a program that is longer in duration than a magnetic tape in said recording device allows, has frames dropped from it to fit within the desired time limit.

60. The apparatus of claim 54, wherein the output of said recording device is routed to said Input Section, allowing said recording device to act as a storage back up system, said recording device accepts overflow storage, TV programs, software updates, or other data that are later retrieved and sent to said Input Section.

61. An apparatus for the simultaneous storage and play back of multimedia data, comprising:

a physical data source, wherein said physical data source accepts broadcast data from an input device, parses video and audio data from said broadcast data, and temporarily stores said video and audio data;

a source object, wherein said source object extracts video and audio data from said physical data source;

a transform object, wherein said transform object stores and retrieves data streams onto a storage device;

wherein said source object obtains a buffer from said transform object, said source object converts video data into data streams and fills said buffer with said streams;

wherein said source object is automatically flow controlled by said transform object;

a sink object, wherein said sink object obtains data stream buffers from said transform object and outputs said streams to a video and audio decoder;

wherein said decoder converts said streams into display signals and sends said signals to a display;

wherein said sink object is automatically flow controlled by said transform object;

a control object, wherein said control object receives commands from a user, said commands control the flow of the broadcast data through the system; and

wherein said control object sends flow command events to said source, transform, and sink objects.

* * * * *

EXHIBIT B

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

TIVO INC.,	§	
	§	
Plaintiff,	§	
	§	
v.	§	**2:04-CV-1-DF**
	§	
ECHOSTAR COMMUNICATIONS CORP., et al.	§	
	§	
	§	
Defendants.	§	

CLAIM CONSTRUCTION ORDER

Before the Court are EchoStar's Opening Claim Construction Brief (Dkt. No. 79), filed April 11, 2005, TiVo Inc.'s Opening Brief on Claim Construction (Dkt. No. 80), filed April 11, 2005, TiVo Inc.'s Opposition Brief on Claim Construction (Dkt. No. 97), filed May 12, 2005, and EchoStar's Response to TiVo's Opening Brief on Claim Construction (Dkt. No. 98), filed May 12, 2005. The Court conducted a claim construction hearing on May 23, 2005. The Parties provided the Court with copies of their slide presentations from the hearing and a Joint Claim Construction Chart (Dkt. No. 120), filed June 7, 2005. The Court now issues this Order to resolve the Parties' claim construction disputes.

I. FACTUAL AND PROCEDURAL BACKGROUND

Plaintiff TiVo, Inc. (hereafter "TiVo") filed suit against defendants on January 5, 2004, for alleged infringement of U.S. Patent No. 6,233,389 (the "'389 patent"). Defendants (collectively referred to as "EchoStar") are a group of inter-related companies who together operate or support a satellite television service called the Dish Network in combination with digital video recorders ("DVRs"). TiVo alleges that EchoStar, by making, using, offering to sell, and/or selling digital video recording devices, digital video recording device software, and/or personal television services in the United States, is infringing, has infringed, and/or has contributed to and induced infringement of one or more claims of the '389 patent. In addition, TiVo alleges that such infringement has been willful and deliberate. *See* Amended Complaint for Patent Infringement (Dkt. No. 3), at ¶¶ 11-12 (filed Jan. 15, 2004).

The '389 patent, entitled "MULTIMEDIA TIME WARPING SYSTEM," describes a digital video recorder system that digitally records television signals from analog and digital sources such as cable and satellite television providers. In their briefing and during the claim construction hearing, the parties focused their presentations on claims 1, 31, 32, and 61 of the '389 patent. Clams 1 and 31 are process claims, and claims 32 and 61 are the apparatus claims that respectively correspond to claims 1 and 31. Accordingly, the parties request the Court to construe terms that appear in these claims. The text of each of the claims at issue is set forth below:

> 1. A process for the simultaneous storage and play back of multimedia data, comprising the steps of:
>
> accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards, including, but not limited to, National

Television Standards Committee (NTSC) broadcast, PAL broadcast, satellite transmission, DSS, DBS, or ATSC;

tuning said TV signals to a specific program;

providing at least one Input Section, wherein said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation;

providing a Media Switch, wherein said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components;

storing said video and audio components on a storage device;

providing at least one Output Section, wherein said Output Section extracts said video and audio components from said storage device;

wherein said Output Section assembles said video and audio components into an MPEG stream;

wherein said Output Section sends said MPEG stream to a decoder;

wherein said decoder converts said MPEG stream into TV output signals;

wherein said decoder delivers said TV output signals to a TV receiver; and

accepting control commands from a user, wherein said control commands are sent through the system and affect the flow of said MPEG stream.

31. A process for the simultaneous storage and play back of multimedia data, comprising the steps of:

providing a physical data source, wherein said physical data source accepts broadcast data from an input device, parses video and audio data from said broadcast data, and temporarily stores said video and audio data;

providing a source object, wherein said source object extracts video and audio data from said physical data source;

providing a transform object, wherein said transform object stores and retrieves data streams onto a storage device;

wherein said source object obtains a buffer from said transform object, said source object converts video data into data streams and fills said buffer with said streams;

wherein said source object is automatically flow controlled by said transform object;

providing a sink object, wherein said sink object obtains data stream buffers from said transform object and outputs said streams to a video and audio decoder;

wherein said decoder converts said streams into display signals and sends said signals to a display;

wherein said sink object is automatically flow controlled by said transform object;

providing a control object, wherein said control object receives commands from a user, said commands control the flow of the broadcast data through the system; and

wherein said control object sends flow command events to said source, transform, and sink objects.

32. An apparatus for the simultaneous storage and play back of multimedia data, comprising:

a module for accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards, including, but not limited to, National Television Standards Committee (NTSC) broadcast, PAL broadcast, satellite transmission, DSS, DBS, or ATSC;

a module for tuning said TV signals to a specific program;

at least one Input Section, wherein said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation;

a Media Switch, wherein said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components;

a module for storing said video and audio components on a storage device;

at least one Output Section, wherein said Output Section extracts said video and audio components from said storage device;

wherein said Output Section assembles said video and audio components into an MPEG stream;

wherein said Output Section sends said MPEG stream to a decoder;

wherein said decoder converts said MPEG stream into TV output signals;

wherein said decoder delivers said TV output signals to a TV receiver; and

accepting control commands from a user, wherein said control commands are sent through the system and affect the flow of said MPEG stream.

61. An apparatus for the simultaneous storage and play back of multimedia data, comprising:

a physical data source, wherein said physical data source accepts broadcast data from an input device, parses video and audio data from said broadcast data, and temporarily stores said video and audio data;

a source object, wherein said source object extracts video and audio data from said physical data source;

a transform object, wherein said transform object stores and retrieves data streams onto a storage device;

wherein said source object obtains a buffer from said transform object, said source object converts video data into data streams and fills said buffer with said streams;

wherein said source object is automatically flow controlled by said transform object;

a sink object, wherein said sink object obtains data stream buffers from said transform object and outputs said streams to a video and audio decoder;

wherein said decoder converts said streams into display signals and sends said signals to a display;

wherein said sink object is automatically flow controlled by said transform object;

> a control object, wherein said control object receives commands from a user, said commands control the flow of the broadcast data through the system; and
>
> wherein said control object sends flow command events to said source, transform, and sink objects.

II.
LEGAL PRINCIPLES OF CLAIM CONSTRUCTION

A determination of patent infringement involves two steps. First, the patent claims are construed, and, second, the claims are compared to the allegedly infringing device. *Cybor Corp. v. FAS Techs., Inc.,* 138 F.3d 1448, 1455 (Fed.Cir.1998) (*en banc*).

The legal principles of claim construction were recently reexamined by the Federal Circuit in *Phillips v. AWH Corp.,* --- F.3d --- , 2005 WL 1620331 (Fed. Cir., July 12, 2005). Reversing a summary judgment of non-infringement, an *en banc* panel specifically identified the question before it as: "the extent to which [the court] should resort to and rely on a patent's specification in seeking to ascertain the proper scope of its claims." *Id.* at *4. Addressing this question, the Federal Circuit specifically focused on the confusion that had amassed from its recent decisions on the weight afforded dictionaries and related extrinsic evidence as compared to intrinsic evidence. Ultimately, the court found that the specification, "informed, as needed, by the prosecution history," is the "best source for understanding a technical term." *Id.* at *7 (quoting *Multiform Dessicants, Inc. v. Medzam, Ltd.,* 133 F.3d 1473, 1478 (Fed. Cir. 1998). However, the court was mindful of its decision and quick to point out that *Phillips* is not the swan song of extrinsic evidence, stating:

> [W]e recognized that there is no magic formula or catechism for conducting claim construction. Nor is the court barred from considering any particular sources or required to analyze sources in any specific sequence, as long as those sources are not used to contradict claim meaning that is unambiguous in light of the intrinsic evidence.

Phillips, 2005 WL 1620331, *16 (citations omitted). Consequently, this Court's reading of *Phillips* is that the Federal Circuit has returned to the state of the law prior to its decision in *Texas Digital Sys. v. Telegenix, Inc.,* 308 F.3d 1193 (Fed. Cir. 2002), allotting far greater deference to the intrinsic record than to extrinsic evidence.

Additionally, the Federal Circuit in *Phillips* expressly reaffirmed the principles of claim construction as set forth in *Markman v. Westview Instruments, Inc.,* 52 F.3d 967 (Fed. Cir.1995) (*en banc*), *aff'd,* 517 U.S. 370 (1996), *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576 (Fed. Cir. 1996), and *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111 (Fed. Cir. 2004). Thus, the law of claim construction remains intact. Claim construction is a legal question for the courts. *Markman*, 52 F.3d at 979. The claims of a patent define that which "the patentee is entitled the right to exclude." *Innova*, 381 F.3d at 1115. When construing claim language, claim terms are generally given their ordinary and customary meaning as they would be understood by "a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application." *Phillips*, 2005 WL 1620331, *5; *PC Connector Solutions LLC v. SmartDisk Corp.,* 406 F.3d 1359, 1363 (Fed. Cir. 2005)("A claim cannot have different meanings at different times; its meaning must be interpreted as of its effective filing date."); *see Vitronics*, 90 F.3d at 1582. However, the Federal Circuit stressed the importance of recognizing that the person of ordinary skill in the art

"is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Phillips*, 2005 WL 1620331 at *5.

Advancing the emphasis on the intrinsic evidence, the *Phillips* decision explains how each source, the claims, the specification as a whole, and the prosecution history, should be used by courts in determining how a skilled artesian would understand the disputed claim term. *See, generally, id.* at *6-*9. The court noted that the claims themselves can provide substantial guidance, particularly through claim differentiation. Using an example taken from the claim language at issue in *Phillips*, the Federal Circuit observed that "the claim in this case refers to 'steel baffles,' which strongly implies that the term 'baffles' does not inherently mean objects made of steel." *Id.* at *6. Thus, the "context in which a term is used in the asserted claim can often illuminate the meaning of the same term in other claims." *Id.* Likewise, other claims of the asserted patent can be enlightening, for example, "the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim." *Id.* at *7.

Still, the claims "must be read in view of the specification, of which they are part." *Markman,* 52 F.3d at 978. In *Phillips*, the Federal Circuit reiterated the importance of the specification, noting that "the specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.' " *Phillips*, 2005 WL 1620331 at *7 (quoting *Vitronics*, 90 F.3d at 1582). To emphasize this position, the court cites extensive case law, as well as "the

statutory directive that the inventor provide a 'full' and 'exact' description of the claimed invention." *Id.* at *8, *see also* 35 U.S.C. § 112, para. 1. Consistent with these principles, the court reaffirmed that an inventor's own lexicography and any express disavowal of claim scope is dispositive. *Id.* at *8. Concluding this point, the court noted the consistency with this approach and the issuance of a patent from the Patent and Trademark Office and found that "[i]t is therefore entirely appropriate for a court, when conducting claim construction, to rely heavily on the written description for guidance as to the meaning of the claims." *Id.* at *9.

Finally, the Federal Circuit curtailed the role of extrinsic evidence in construing claims. In pointing out the less reliable nature of extrinsic evidence, the court reasoned that such evidence (1) is by definition not part of the patent, (2) does not necessarily reflect the views or understanding of a person of ordinary skill in the relevant art, (3) is often produced specifically for litigation, (4) is far reaching to the extent that it may encompass several views, and (5) may distort the true meaning intended by the inventor. *See id.* at *11. Consequently, the Federal Circuit expressly disclaimed the approach taken in *Texas Digital*. While noting the *Texas Digital* court's concern with regard to importing limitations from the written description – "one of the cardinal sins of patent law," the Federal Circuit found that "the methodology it adopted placed too much reliance on extrinsic sources such as dictionaries, treatises, and encyclopedias and too little on intrinsic sources, in particular the specification and prosecution history." *Id.* at *13. Thus, the court renewed its emphasis on the specification's role in claims construction.

In light of *Phillips*, this Court will resort to extrinsic evidence only if unable to reach a claim construction based upon the intrinsic record. *Vitronics*, 90 F.3d at 1584 ("Only if there were still some genuine ambiguity in the claims, after consideration of all available intrinsic evidence, should the trial court have resorted to extrinsic evidence…"). Where it is necessary to consider extrinsic evidence to arrive at a construction, such evidence should be used with caution.

Many other principles of claims construction, though not addressed in *Phillips*, remain significant in guiding this Court's charge in claim construction. The Court is mindful that there is a "heavy presumption" in favor of construing claim language as it would be plainly understood by one of ordinary skill in the art. *Johnson Worldwide Assocs., Inc. v. Zebco Corp.*, 175 F.3d 985, 989 (Fed. Cir. 1999). Words in patent claims are given their ordinary meaning in the usage of the field of the invention, unless the text of the patent makes clear that a word was used with a special meaning. *See Multiform Desiccants, Inc.*, 133 F.3d at 1477. Though a patentee may choose to act as his own lexicographer, the intrinsic evidence must 'clearly set forth' or 'clearly redefine' a claim term so as to put one reasonably skilled in the art on notice that the patentee intended to so redefine the claim term. *Bell Atl. Network Servs., Inc. v. Covad Communs. Group, Inc.*, 262 F.3d 1258, 1268 (Fed. Cir. 2001)(internal citations omitted).

Claim construction is not meant to change the scope of the claims but only to clarify their meaning. *Embrex, Inc. v. Service Eng'g Corp.*, 216 F.3d 1343, 1347 (Fed. Cir. 2000)("In claim construction the words of the claims are construed independent of the accused product, in light of the specification, the prosecution history, and the prior

art. . . . The construction of claims is simply a way of elaborating the normally terse claim language[] in order to understand and explain, but not to change, the scope of the claims.")(citations and internal quotations omitted). Though a claim or claim term may be used according to its plain meaning, where appropriate, this Court offers claim construction for clarification.

Each term used in a claim is presumed to have meaning. *Innova,* 381 F.3d at 1119 ("While not an absolute rule, all claim terms are presumed to have meaning in a claim."). Thus, a claim construction that would render terms meaningless or redundant is presumably incorrect. Where different terms are used in a claim, a court can infer that the patentee intended that the terms have different meanings. *Id.* Similarly, a claim term is generally given the same construction throughout the specification and the claims. *See id.; Phillips*, 2005 WL 1620331 at *7 ("Because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.").

III.
DISCUSSION

Having reviewed the principles of claims construction, the Court now turns to a discussion of the patent in suit and the disputed terms that appear in claims 1, 31, 32, and 61.

A. Claims 1 and 32

1. "accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards"

TiVo argues no construction is needed for this limitation, or, if construed, should be defined as "accepting transmitted television programming that is based on one or more established specifications." *See* TiVo's Op. Br. 5-7; TiVo's Markman Slides at 51-60.

EchoStar argues "multitude" means "a large number." EchoStar's Opening Br. at 6-8; EchoStar's Slide Presentation at 49-53. During the claims construction hearing, EchoStar stated that "the plain meaning of multitude [is] many, a large number… It is not a specific technical term." 5/23/05 Hr. Tr. at 92:14-17. EchoStar further argues "accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards" means "accepting for processing a large number of different TV broadcast signals formatted in conformance with different TV broadcast signal standards." EchoStar's Opening Br. at 6-8; EchoStar's Slide Presentation at 49-53.

Though "multitude" is a term that is understood by persons of skill in the art, for clarification purposes, the Court defines it as "numerous." The construction proposed by defendant, "a great number," does not clarify the meaning of the term "multitude" and instead only adds ambiguity as the term "great" is a term of degree in need of further construction. The Court's construction accords with the plain meaning of the term "multitude" and with the use of the term in the patent claims and the patent specification. '389 patent at col. 2:4-10; 3:32-37; *see also* '389 patent Abstract. Further, as written, the claim language requires an invention that accepts TV broadcast signals that are based on a multitude of standards – not that the invention actually process a multitude of TV broadcast standards. *See* TiVo Op. Br. at 6-7.

Though not determinative in the Court's decision, it is of note that construing "multitude" as "numerous" further accords with extrinsic evidence proffered by defendant. *See* EchoStar's Opening Br. at 6-7 citing Exh. D, THE AM. HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE (4th ed. 2000) at 1156 ("multitude. n.: 1. the condition or quality of being numerous") and Exh. E, the OXFORD ENGLISH DICTIONARY ONLINE, 2004 ("multitude. n. 1. A mass noun: the character, quality, or condition of being many; numerous").

The Court finds that the remaining terms do not require construction.[1] Therefore, the Court construes "accepting television (TV) broadcast signals, wherein said TV signals are based on a multitude of standards" as "**accepting television (TV) broadcast signals, wherein said TV signals are based on numerous standards**."

2. "tuning said TV signals to a specific program"

TiVo argues no construction is needed for these terms, or, if construed, should mean "adjusting the system to receive signals at a particular frequency or a particular program." *See* TiVo's Op. Br. at 7-8; '389 patent at col. 3:37-46; TiVo's Markman Slides at 61-68.

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[1] EchoStar argues that the claim term "standards" is indefinite and renders the entire claim invalid. EchoStar Opening Br. at 2, 20-22. Whether or not the claim is indefinite, however, is an invalidity question and should be raised in the context of a summary judgment motion. Patents are presumed valid. 35 U.S.C. § 282. During claim construction, courts will construe claims unless, because of an ambiguity, one of ordinary skill in the art could not reasonably understand the scope of the claim. *See Exxon Research and Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001); *see also Phillips*, 2005 WL 1620331 at *19 (noting that a validity analysis is not a regular component of claim construction). Presently, this Court finds the term "standards" is not so ambiguous that the claim cannot be construed.

EchoStar argues these terms should be defined as "using a tuner to select a radio frequency bandwidth that carries exactly one television program at a time." EchoStar's Opening Br. at 8-9; EchoStar's Response Br. at 15; EchoStar's Slide Presentation at 54-58.

The specification does not explicitly define "a specific program." The claim term "a specific program" does not appear in the specification. Based, however, on its use in the claims, the Court finds that one of ordinary skill in the art would understand "a specific program" is to mean "a specified frequency range." The Court finds that the claim term "tuning" was used according to its plain meaning in the '389 patent and does not require further construction.

Therefore, the Court defines "tuning said TV signals to a specific program" as **"tuning said TV signals to a specified frequency range."**

3. "Input Section" and "converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream"

TiVo argues no construction of these terms is needed, or, if construed, should be limited to the definition of "Input Section" as "hardware and/or code that changes or adapts the form or function of the TV program data to an MPEG format suitable for internal transfer and manipulation." *See* TiVo's Op. Br. at 8-11; '389 patent at cols. 2:13-14, 3:30-4:2, 6:26-27, 6:30-33, 12:40-42, 12:44-47; TiVo's Markman Slides at 69-84.

EchoStar argues "Input Section" is specially defined by the '389 patent as "a separate module that obtains input from outside an assembly, tunes to a signal carrying a

particular television program, and includes an MPEG encoder that encodes the program into MPEG."[2] '389 patent at cols. 3:32-33, 3:43-52, 4:15, & Fig. 1; EchoStar's Opening Br. at 16-17; EchoStar's Response Br. at 15; EchoStar's Slide Presentation at 99-104.

EchoStar further argues "said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream" means "the Input Section changes the format of the TV program data signal from non-MPEG to MPEG." *See* '389 patent at col. 2:10-14; EchoStar's Opening Br. at 9-11, 16-17; EchoStar's Response Br. at 15; EchoStar's Slide Presentation at 59-75.

The Court need look no further than the claims themselves to define these terms, as the specification does not explicitly define them. *See* '389 patent at cols. 12:43-46, 15:25-28. The plain and ordinary meaning of an "Input Section" is "the portion of a device that receives inputs." The claim term "converts" needs no further construction. Though EchoStar argued in favor of construing "convert" as "change," no such construction is necessary.[3]

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[2] In support of its proffered construction, EchoStar argues that the capitalization of terms in a patent indicates that the terms were specially defined by the patentee and therefore must be given a special meaning instead of their plain meaning. EchoStar argues that because three terms in the '389 patent were capitalized – Input Section, Media Switch, and Output Section – the patentee necessarily acted as his own lexicographer and that these terms cannot be construed to have a plain meaning. EchoStar Opening Br. at 15 ("By using terms that are proper nouns and not generic terms of art, the applicants acted as their own lexicographers… In order to understand what was intended by the capitalized terms, therefore, one must refer to the specification."). Notably, EchoStar does not cite any patent cases for this proposition and instead, draws an analogy to contract law wherein, EchoStar argues, capitalization of a term indicates the creation of a term of art. *Id.* This Court has not found this rule in patent case law and does not here create such a rule. Instead, this Court will follow Federal Circuit precedent in determining whether or not a patentee chose act as his own lexicographer. *Bell Atl. Network Servs., Inc. v. Covad Communs. Group, Inc.*, 262 F.3d 1258, 1268 (Fed. Cir. 2001).

[3] EchoStar cites *Superguide Corp. v. DirectTV Eters., Inc.*, 358 F.3d 870, 891 (Fed. Cir. 2004) in support of its proposed construction of "convert." EchoStar argues that in that case, the Federal Circuit "[held] that in the television broadcasting field, the ordinary meaning of 'convert' is 'changing from one form or format to another.'" In *Superguide*, the Federal Circuit considered the construction of a claim phrase containing the term "converting." In support of their respective proposed constructions, the two parties each proposed

Therefore, the Court construes "providing at least one Input Section, wherein said Input Section converts said specific program to an Moving Pictures Experts Group (MPEG) formatted stream for internal transfer and manipulation" as **"providing at least one portion of a device that receives inputs, wherein said portion of the device that receives inputs converts said specified frequency range to an Moving Picture Experts Group (MPEG) formatted stream for internal transfer and manipulation."**

4. "Media Switch" and "parses said MPEG stream, said MPEG stream is separated into its video and audio components"

TiVo argues "Media Switch" means "hardware and/or code that connects with CPU and memory." TiVo's Opening Br. at 8-9; TiVo's Op. Br. at 19-21; '389 patent at col. 3:62-64 ("The Media Switch 102 mediates between a microprocessor CPU 106, hard disk or storage device 105, and memory 104."); *id.* at cols. 2:22-25, 6:59-63, 7:5-23, 14:21-22; TiVo's Markman Slides at 85-97.

EchoStar argues "Media Switch" is specially defined by the '389 patent as "a hardware module that is separate from the computer's CPU, is connected to temporary memory, receives MPEG data representing a television program from one or more Input Sections, parses data into separate video and audio components, using a parser that detects the start of all important events in a video or audio stream and the start of all frames, sends the data to a storage device, retrieves the data from the storage device, and

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constructions of "converting" that used the term "change" and the district court's final construction of the term construed "conversion" as "change." The construction of this term, however, was not squarely before the court. Further, though the Federal Circuit, affirmed the district court's claim construction, the court did not hold generally that the ordinary meaning of "conversion" in the television broadcasting field is "change."

sends it to one or more Output Sections." *See* '389 patent at cols. 3:62-4:2, 5:51-64, 6:16-46, 6:59-65; 7:19-26; 8:44, & Figs. 1, 2, 7 & 13; EchoStar's Response Br. at 4-7; EchoStar's Slide Presentation at 99-112.

The Court finds that the specification is the best guide to the meaning of the term "Media Switch." As used in the '389 patent, "Media Switch" is hardware and/or code that mediates between a microprocessor CPU, hard-disk or storage device, and memory." This definition is consistent with the use of the term in the patent claims and specification. *See* '389 patent at col. 3:62-4:2, 4:34-36, 4:55-58, 5:34-36, 6:16-27, 6:59-65, 7:5-11. Neither the claims nor specification limit the Media Switch to a physical device.

Regarding the term "parse", TiVo construes "parse" as "analyze" arguing that "parses said MPEG stream, said MPEG stream is separated into its video and audio components" means "analyzes an MPEG stream, the MPEG stream having distinguished video and audio components." TiVo's Opening Br. at 9-11; TiVo's Op. Br. at 11-13; '389 patent at cols. 4:26-30, 5:3-6, 5:33-36, 6:36-58, & Figs. 6 & 13; TiVo's Markman Slides at 98-112.

EchoStar argues "parses" means "separates," and "said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components" means "the Media Switch must analyze the content of an MPEG Systems stream carrying one television program and from it output two distinct streams: one video MPEG stream and one audio MPEG stream." *See* '389 patent at Fig. 3 & col. 4:23-29; EchoStar's

Opening Br. at 11-12; EchoStar's Response Br. at 7-10; EchoStar's Slide Presentation at 76-98; 6-7-05 Joint Claims Construction Chart at 3.

Although the court finds persons of ordinary skill in the art understand the meaning of the term "parses," for clarification purposes, it defines the term as "analyzes." The claim language and the specification are instructive in this regard as both "parse" and "separate" are at times used in the same sentences and claims indicating that the terms are not interchangeable. '389 patent at col. 2:15-16; claims 1 and 32; Abstract; *see Innova,* 381 F.3d at 1119 (noting that each term used in a claim is presumed to have meaning and that it is permissible to infer, where different terms are used in a claim, that the patentee intended a differentiation in the meaning of those terms). As further evidence that the terms are not interchangeable, "parse" is often used without the term "separate" several times in the specification. '389 patent at cols. 2:22-24, 4:52-54, 5:3-6, 6:36-39, 7:12-16; '389 patent Abstract; *see Innova,* 381 F.3d at 1119; *see Phillips*, 2005 WL 1620331 at *7.

Therefore, the Court construes "providing a Media Switch, wherein said Media Switch parses said MPEG stream, said MPEG stream is separated into its video and audio components" as **"providing hardware and/or code that mediates between a microprocessor CPU, hard-disk or storage device, and memory, wherein said device, portion of a device, or code analyzes said MPEG stream, said MPEG stream is separated into its video and audio components."**

5. "storing said video and audio components on a storage device"

TiVo argues no construction of these terms is needed, or, if construed, should mean "storing program data to memory." *See* TiVo's Op. Br. at 11-13; '389 patent at cols. 4:1-2, 6:4-8, 6:56-63, 12:53-60; TiVo's Markman Slides at 113-21.

EchoStar argues "storing said video and audio components on a storage device" means "the video MPEG stream and audio MPEG stream are stored as separate components on a hard disk or other computer storage device." *See* EchoStar's Opening Br. at 12-13; EchoStar's Slide Presentation at 76-98.

Upon review of the parties' briefs and of the patent, the Court finds that these terms do not require construction.

6. "Output Section," "extracts said video and audio components from said storage device," and "assembles said video and audio components into an MPEG stream"

TiVo argues no construction of these terms is needed, or, if construed, should mean "hardware and/or code that takes program data from memory and brings it together as an MPEG stream for playback." *See* TiVo's Op. Br. at 15-16; '389 patent at cols. 4:23-33, 4:45-54, 5:33-6:15, 7:12-16; TiVo's Markman Slides at 122-31.

EchoStar argues "Output Section" is specially defined by the '389 patent as "a separate module that decodes an MPEG stream and produces TV output signals." *See* '389 patent at cols. 3:65-4:6 & Figs. 1 & 13; EchoStar's Opening Br. at 19-20; EchoStar's Slide Presentation at 99-104.

EchoStar further argues "said Output Section extracts said video and audio components from said storage device" means "the Output Section must obtain the

separate video stream and audio stream from the storage device." *See* EchoStar's Opening Br. at 14; EchoStar's Slide Presentation at 76-98.

EchoStar further argues "said Output Section assembles said video and audio components into an MPEG stream" means "the Output Section must multiplex the separate video stream and audio stream into one MPEG Systems stream." *See* EchoStar's Opening Br. at 14; EchoStar's Slide Presentation at 82, 98.

The Court finds it need look no further than the claims themselves to define these terms, as the specification does not explicitly define them, and the claims are presumed to represent the understanding of those of ordinary skill in the art. *See* '389 patent at cols. 12:53-55, 15:35-37; TiVo's Op. Br. at Gibson Decl., ¶ 38 (corollary of definition of "Input Section" for "Output Section" is the portion of a device that receives outputs). The plain and ordinary meaning of an "Output Section" to one of ordinary skill in the art is **"the portion of a device that decodes data from memory and produces output signals."** This definition is consistent with the use of the term in claims 1 and 32 and the context of the specification.

The Court finds it unnecessary to construe "extracts said video and audio components from said storage device" or "assembles said video and audio components into an MPEG stream." Further, the Court disagrees with EchoStar's argument that "extracts" should be construed as "obtains." In claims 31 and 61, both the terms "extract" and "obtain" are used. Each of these terms is presumed to have a separate meaning, and each term is presumed to have the same meaning throughout the patent claims. *See Innova,* 381 F.3d at 1119; *see also Phillips*, 2005 WL 1620331 at *7.

Although the term "obtain" is not used in claims 1 and 32, both terms are found in claims 31 and 61. Thus, in order to construe "extract" consistently in each of the four claims, "extract" cannot mean "obtain" or the construction would violate the presumption that each term has its own meaning and that the use of different terms reflects a differentiation in meaning. There is no evidence rebutting these presumptions. Thus, "extracts" cannot be construed as "obtains."

7. "control commands"

TiVo argues no construction of "control commands" is needed, or, if construed, should mean "commands that control the DVR system." TiVo's Opening Br. at 12; '389 patent at cols. 12:65-67, 15:47-49.

EchoStar argues "control commands" means "commands that are accepted and sent through the system" and "affect the flow of said MPEG stream, including, for example, reverse, fast forward, play-pause, fast/slow reverse play, and fast/slow play."[4] *See* '389 patent at col. 2:33-37; EchoStar's Response Br. at 14.

The court finds "control commands" is defined clearly by claims 1 and 32, with no indication from the specification that any specific meaning should attach. Therefore, for purposes of clarification, the Court defines "control commands" as "**commands that control the system.**"

[4] EchoStar argues that "said MPEG stream" is indefinite and cannot be construed due to a lack of antecedent basis for the term. EchoStar's Opening Br. at 20-21; EchoStar's Slide Presentation at 134-36. EchoStar also argues claim 32 is indefinite because it combines apparatus and process limitations in a single claim. EchoStar Opening Br. at 21-22. As discussed above in footnote 1, definiteness is a validity challenge that should be raised by summary judgment motion.

B. Claims 31 and 61

1. "parses video and audio data from said broadcast data"

TiVo argues these terms should be construed to mean "analyzes video and audio data." *See* TiVo's Opening Br. at 9-11; TiVo's Op. Br. at 11-13; '389 patent at cols. 5:3-6, 5:33-36, 6:36-58, & Fig. 6; TiVo's Markman Slides at 135-39; *see also id.* at col. 12:48-50 (". . . parses said MPEG stream . . .").

EchoStar argues "parses" means "separates," and "parses video and audio data from said broadcast data" means "analyzes the content of broadcast data and from it transmits two distinct components: one video component and one audio component." *See* '389 patent at Fig. 3 & col. 4:23-29; EchoStar's Opening Br. at 11-12; EchoStar's Response Br. at 7-10; EchoStar's Slide Presentation at 76-98, 123-24.

As was the Court's analysis of the term "parses" in the context of claims 1 and 32, the Court similarly finds that "parse" as it is used in claims 31 and 61 means "analyzes." These terms are recited clearly by claims 31 and 61 and understood by persons of ordinary skill in the art. *See* '389 patent at cols. 14:55-58, 18:5-8. This definition is consistent with the use of the term in claims 31 and 61 and the context of the specification. *See, e.g.,* '389 patent at col. 4:23-33 & Fig. 3 (describing the analysis of interleaved video and audio streams from an incoming MPEG stream).

Therefore, the court defines "parses video and audio data from said broadcast data" as "**analyzes video and audio data from the broadcast data.**"

2. "obtains a buffer"

TiVo argues this claim term is newly raised by EchoStar after the claim construction hearing and believes no construction is needed. 6/7/05 Joint Claims Construction Chart at 9. EchoStar argues "obtains a buffer" means "obtains a set of buffer memory addresses into which it can write data." *See* '389 patent at cols. 7:47-50, 8:9-18; 8:38-65, & Fig. 8; EchoStar's Opening Br. at 23-25; EchoStar Slide Presentation at 127-28. The Court, however, finds "obtains a buffer" requires no construction, as persons of ordinary skill in the art readily understand its meaning as written in claims 31 and 61.

The Court finds that, although the term "buffer" has a plain and ordinary meaning to persons of skill in the art, it requires additional construction for clarification. Because neither party has offered a stand-alone construction for this term in their papers, and is not defined in the '389 patent, the Court turns to extrinsic evidence in order to assist its understanding of the term. *Phillips*, 2005 WL 1620331 at *15. In this instance, the Court turns to technical dictionary published by the Institute of Electronic and Electrical Engineers, the IEEE STANDARD DICTIONARY OF ELECTRICAL AND ELECTRONICS TERMS (6th ed. 1997), which defines "buffer" as: "(5)(A) A device or storage area used to store data temporarily to compensate for differences in rates of data flow, the time occurrence of events, or amounts of data that can be handled by the device or process involved in the transfer or use of the data." IEEE STANDARD DICTIONARY OF ELECTRICAL AND ELECTRONICS TERMS at 113 (6th ed. 1997). The Court notes that EchoStar's expert witness, Dr. Rhyne, has acknowledged that the IEEE dictionary this is a widely accepted technical dictionary in the electrical engineering field. Rhyne Decl. at 45. On the basis

of the use of the term in the '389 claims, and on the basis of its IEEE dictionary definition, "buffer" will be construed as "memory where data can be temporarily stored for transfer." This definition is further consistent with the definition provided by counsel during the claims construction hearing. 5/23/05 Hr. Tr. 58:11-13.

The claim phrase as a whole, "obtains a buffer" is therefore construed as **"obtains memory where data can be temporarily stored for transfer."**

3. "automatically flow controlled"

TiVo argues these terms mean "the flow of data is self-regulating." *See* TiVo's Op. Br. at 24-26; '389 patent at col. 8:48-49 ("[T]he pipeline is self-regulating; it has automatic flow control."); *id.* at col. 8:39-65; TiVo's Markman Slides at 166-80.

EchoStar argues the terms mean "the transform object controls when and where video and audio data is stored by the source object." *See* EchoStar's Opening Br. at 26-27; EchoStar's Slide Presentation at 125-31.

The Court agrees with TiVo's position and defines "automatically flow controlled" as "**self-regulated**" due to its clear definition in the specification. *See* '389 patent at col. 8:48-49.

4. "source object"

TiVo argues an "object" is "a collection of data or operations, i.e., portions of a computer program." *See* TiVo's Opening Br. at 11-12; TiVo's Op. Br. at 21-22, *citing* IEEE 100: THE AUTHORITATIVE DICTIONARY OF IEEE STANDARD TERMS at 752 (7th ed. 2000)(defining "object" as "a collection of data and operations"); TiVo's Markman Slides at 140-53. It further argues no construction beyond "object" is needed for "source

object" or, if construed, should mean "the portion of a computer program that (1) 'extracts video and audio data from said physical data source,' (2) 'converts video data into data streams,' (3) 'obtains a buffer from said transform object,' and (4) 'fills said buffer with said streams.'" *See* TiVo's Op. Br. at 22; '389 patent at cols. 7:48-50, 8:39-40, 14:59-61, 14:65-67, 18:9-10, 18:13-15; TiVo's Markman Slides at 140-53.

EchoStar argues "object" means "an item written with an object-oriented computer programming method (for example, in C++) that encapsulates data and the procedures necessary to operate on that data and can inherit properties from a class or another object." *See* '389 patent at cols. 8:9-18, 8:40-42, 11:27; EchoStar's Opening Br. at 22-23; EchoStar's Response Br. at 10-14; EchoStar's Slide Presentation at 113-20.

EchoStar further argues "source object" means "a software object that serves as a point of origin of video and audio data." *See* '389 patent at cols. 7:47-50, 8:9-18; 8:38-65, & Fig. 8; EchoStar's Opening Br. at 23-25; EchoStar's Slide Presentation at 127-28.

After a thorough examination of the intrinsic record, the Court has concluded that "object" is used according to its plain meaning to one of ordinary skill in the art at the time of the invention. Neither the claims nor specification, however, elaborate on the plain meaning of this term. The Court therefore turns to extrinsic evidence in order to assist its understanding of the term. *Phillips*, 2005 WL 1620331 at *15. In this instance, the Court looked to a technical dictionary, the IEEE 100: THE AUTHORITATIVE DICTIONARY OF IEEE STANDARD TERMS at 752 (7^{th} ed. 2000) which defines "object" as "a collection of data and operations." The Court notes that EchoStar's expert witness, Dr. Rhyne, has acknowledged that this is a widely accepted technical dictionary in the

electrical engineering field. Rhyne Decl. at 45. Thus, for clarification purposes the Court construes "object" as "a collection of data and operations." This same construction of "object" applies to the terms "transform object," "sink object," and "control object."

The Court further finds that persons of ordinary skill in the art readily understand the meaning of "source object" upon a reading of the claim language and its context in the specification. *See* '389 patent at cols. 14:59-61, 14:65-15:2, 15:15-16, 18:9-10, 18:13-17, 18:29-30. The specification states: "[w]ith respect to FIG. 8, the program logic within the CPU has three conceptual components: sources 801, transforms 802, and sinks 803." *Id.* at col. 7:48-50. In addition, specification describes a class hierarchy of the program logic according to the invention and refers to the source 901, transform 902, and sink 903 objects. *See id.* at col. 8:9-18 & Fig. 9. Therefore, in accordance with its ordinary meaning, the Court construes "source object" as "**a collection of data and operations that (1) extracts video and audio data from a physical data source, (2) obtains a buffer [memory where data can be temporarily stored for transfer] from a transform object, (3) converts video data into data streams, and (4) fills the buffer [memory where data can be temporarily stored for transfer] with the streams.**"

5. "transform object"

TiVo argues no construction for this term beyond a definition for "object" is necessary, or, if construed, should mean "the portion of computer program that 'stores and retrieves data streams onto a storage device.'" *See* TiVo's Op. Br. at 22-23; '389 patent at cols. 7:48-50, 8:39-40, 14:62-64, 18:11-12; TiVo's Markman Slides at 140-49, 154-57.

EchoStar argues "transform object" means "a software object that changes the form of the data upon which it operates." *See* '389 patent at cols. 7:47-57, 7:66-8:18, 8:49-65, & Fig. 8; EchoStar's Opening Br. at 23-25; EchoStar's Slide Presentation at 121-22.

The Court finds it need look no further than the claims themselves to arrive at the plain and ordinary meaning for this term. For clarification purposes, however, this Court construes the term "transform object" as **"a collection of data and operations that transforms the form of data upon which it operates."**

6. "sink object" and "obtains data stream buffers"

TiVo argues these terms require no construction beyond a definition for "object," or, if construed, should mean "the portion of computer program that '[1] obtains data stream buffers from said transform object and [2] outputs said streams to a video and audio decoder.'" *See* TiVo's Op. Br. at 23; '389 patent at cols. 7:48-50, 8:39-40, 15:3-5, 18:19-21; TiVo's Markman Slides at 140-49, 158-62.

EchoStar argues "sink object" means "a software object that receives video and audio data." *See* '389 patent at cols. 7:47-57, 8:8-18, 8:52-65; EchoStar's Opening Br. at 23-25; EchoStar's Slide Presentation at 127-28. EchoStar further argues that "obtains data stream buffers" means "obtains a set of buffer memory addresses from the transform object and reads the data from that buffer." *See* EchoStar's Opening Br. at 28; EchoStar's Response Br. at 14.

The term "object" will be construed throughout the patent as set forth above. In light of the claims and specification, a "sink object" will be construed as **"a collection of**

data and operations that (1) obtains data stream buffers [memory where data can be temporarily stored for transfer] from a transform object and (2) outputs the streams to a video and audio decoder."

Further, the Court finds that the claim phrase "obtains data stream buffers" has a plain meaning readily understood by persons of ordinary skill in the art. For clarification purposes, however, the Court incorporates its definition of "buffer" and construes the claim phrase as **"obtains data stream buffers [memory where data can be temporarily stored for transfer]."**

7. **"control object"**

TiVo argues no construction of this term beyond a definition for "object" is necessary, or, if construed, the term should mean "the portion of a computer program that (1) 'receives commands from a user, said commands control the flow of the broadcast data through the system'; and (2) 'sends flow command events to said source, transform, and sink objects.'" *See* TiVo's Op. Br. at 23-24; '389 patent at cols. 7:48-50, 8:39-40, 15:11-16, 18:26-30; TiVo's Markman Slides at 140-49, 163-65.

EchoStar argues "control object" should have the same construction as "control commands."

The Court finds that persons of ordinary skill in the art readily understand the meaning of "control object" upon a reading of the claim language and its context in the specification. *See* '389 patent at cols. 7:48-49, 8:9-18, 15:10-12, 18:28-29. Therefore, in accordance with its ordinary meaning, the Court construes "control object" as **"a**

collection of data and operations that receives commands from a user that control the flow of broadcast data."

IV.

CONCLUSION

For the foregoing reasons, the Court enters this claim construction order.

SIGNED this 18th day of August, 2005.

DAVID FOLSOM
UNITED STATES DISTRICT JUDGE

Exhibit C
Removed for Confidentiality